RAILROAD GAZETTE

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Contributions

Classifying Locomotives—Another Suggestion.

Creston, Iowa, May 18, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

"Roadmaster" in your issue of May 15, shows two methods of indicating the different classes of locomotives, first the sketch showing the side views of the wheels, and second, the same thing designated by small and large figures. But why use figures at all? The sketch method is perfectly clear—more so than the figures. This figure method cannot be made on an ordinary typewriter, but with a change in the symbol for the "cowcatcher" the sketch method can be used. To be sure, the wheels are a little "out of round," but that will do no harm.

Here is what I would recommend as the clearest, simplest and most convenient method of indicating the different classes of locomotives. It needs no explanation.

ATOM.

An Old Time Runaway.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Nearly 35 years ago, when I was an operator at Acton, on the Grand Trunk, about 35 miles west of Toronto, an incident occurred which was the most startling of my life. The "Doon" freight had just arrived. This freight train started each morning from Doon, near Berlin, to bring down the loaded freight cars between the latter point and Acton, destined for Toronto. The reason for this was that the regular freight train could here couple up with the Doon cars and take the double trainload from Acton to Toronto because of the down-grade between these stations. I was walking up and down the platform in front of the depot, enjoying the sun and fresh air, when I heard some one shouting. Looking down the track I saw one of the Doon train's brakemen running towards me at full speed. His hat was off, and he was swinging his arms, turning half way around sometimes and pointing down the track.

I guessed that a car had got away and started down the grade, and that, with a clear track, it wouldn't stop until it got to Toronto. I knew that No. 1 express was due at Georgetown, the next telegraph station, six miles away, at 1 p.m., five minutes ago, and that it was probably on time, having but a few stops to make between Toronto and Sarnia.

I used the emergency signal "17," which had precedence over everything, and called "N" (despatcher's office) and "NR" (Georgetown). They both answered promptly. By this time the brakeman came and was panting out his story that a car loaded with timber and ties had got away from him and went rushing down the steep grade, and "for God's sake to stop No. 1." I telegraphed this as quick as possible, and when I had done it the despatcher's order ticked: "To 'NR,' stop No. 1." Then I heard "I'll try." "OK."

It was pretty quiet then for about 10 minutes. I guess every operator on the wire between Toronto and Sarnia had heard the messages and understood. We held our breaths and so did the wire, for not a click was heard. Poor Hushing, the brakeman, was the only one who talked, and he did not talk well, but, between sobs, he explained that after the car had been tail-roped out of the blind siding, he had tried to stop it just below the switch, where the steep grade began, but that the brake-chain broke. Then he threw off ties until the car finally balanced itself on top of one, when he thought he had it checked, and jumped off. But the car again started and got away from him. We all know what a carload of heavy timber would do to No. 1 and its passengers, if it caught them, for a few years before this a carload of stone had broken away at about the same place and did not stop until it had reached Toronto. The words on the wire that finally broke the silence were sweet indeed. They came from the Georgetown operator: "No. 1 is safe, the car is in the ditch and no one is hurt."

No. 1 express happened to be five minutes late that day, something unusual, and was just pulling out, when Georgetown heard my call. The words were no sooner tapped on the wire than he reached up and pulled the rope that turned the signal in front of the station, which all engineers were required to watch until a certain distance away. This engineer was on the alert, believing, perhaps, with Patrick Henry, in "Eternal vigilance" and whistled for brakes. Then the agent hurried an order to the switchman, who had just time to throw the switch over for the siding, and also order a number of section men who happened at that time to be repairing the track in front of the station, to pile up ties on the track. The next thing the ties were flying in the air and the runaway went down the bank.

CHARLES W. THAYER.

Santa Ana, California.

Master Boiler Makers' Convention.

The second annual convention of the International Railway Master Boiler Makers' Association was held at Columbus, Ohio, May 19, 20 and 21, with 100 delegates in attendance.

The secretary's report showed 103 active members, and a substantial balance in the treasury. Denver was chosen as the next meeting place and the following officers were elected: F. J. Graves, C. & O., Huntington, W. Va. (Past President), Chairman of the Board of Finance; J. A. Doarnberger, N. & W., Roanoke, Va., President; W. H. Laughridge, Hocking Valley, Columbus, Ohio, First Vice-President; J. T. Goodwin, Richmond Locomotive Works, Second Vice-President; C. L. Hemple, C., B. & Q., Omaha, Neb., Third Vice-President; James Johnston, N. P. Ry., St. Paul, Minn., Fourth Vice-President; W. J. Richie, C., O. & G., Shawnee, Okla. T., Secretary and Treasurer.

ADDRESS OF PRESIDENT F. J. GRAVES.

. . . We who have entrusted to our care and supervision the building and repairing of locomotive boilers have long felt the want of an association, at the meetings of which we might discuss the various methods practiced in different localities; study questions of economy in the work assigned to us, and by an interchange of ideas, arrive at the most practical and economical methods, consistent with good work. . . . We must, however, proceed with caution, and not let our zeal for making progress blind us to the fact that the best is the cheapest.

Twelve subjects have been assigned to as many different committees, and while each of these subjects is of great importance, particular attention is called to the Maintenance of Boilers and Roundhouse Work, and The Best Method of Washing Boilers. The roundhouse boiler work, and the washing of boilers are parts of our work which, as a general thing, do not receive the attention which they merit from the foreman in charge.

Judging from the rapid growth of our association from its birth to the present time, and the enthusiasm manifested in it, not only by its members, but by prominent railroad officials, we feel safe in predicting a bright future for it. Those men who met in St. Louis last November for the purpose of organizing the International Railway Master Boiler Makers' Association were perfectly familiar with the existing conditions, and believed the time was ripe for the master boiler makers to have an organization, and the association was organized as a strictly railroad organization, and we believe it should be conducted by and in the interest of railroad master boiler makers. I am especially proud of the rapid growth of the association, which I consider due to the interest manifested in the association by the higher railroad officials, and the loyalty and faithful work of the members. . . . One of the prime objects of the association is the advancement of knowledge in the construction and repairs of locomotive boilers.

Extracts from some of the reports follow:

BEST METHOD OF WELDING FLUES.

After the reading of a report on the best method of welding flues, a sub-committee was appointed to report the opinion of the members on the subject. They reported as follows:

First.—All flues should be lap welded, to lap not less than one-half inch.

Second.—The welding heat should be kept from end of flue as much as possible.

Third.—The flue should be reversed each time in putting on new pieces.

Fourth.—A roller machine for welding has been adjudged by the association to be superior to a hammer machine.

Fifth.—Oil is recommended as fuel; making a cleaner weld and saving time and labor.

The report is signed by Messrs. Floyd Harris, J. T. Johnston, W. A. Schultz, H. W. Peterman, Charles Krauss.

CAUSE AND PREVENTION OF MUD RINGS LEAKING.

By Mr. W. H. Laughridge, Foreman Boiler Maker, Hocking Valley.

The mud ring and a portion of the sheets adjacent being below the fire are practically cold, while that portion of the sheets above the grates are subjected to a very intense heat, which causes the sheets to expand. As there is no provision made to take care of the forward and backward thrust of the side sheets, the flanges of the flue and door sheets receive the thrust when the sheets are elongated by the expansion. The resistance of the flanges and staybolts in the sheets, combined with the steam pressure on one side and fire upon the other, causes the sheets to buckle or corrugate, which results in the shortening of the same and by this shortening of the sheets the pitch of the staybolts is reduced, which causes a radial strain upon the outer side sheets. This strain, in combination with the powerful stress brought upon the fire-box sheet when contraction takes place, causes both inside and outside sheets to bow outward and forces the ring to do the same, thus producing a strain upon the inside corner of the ring that loosens the calking. The expansion of the inner side sheets longitudinally combined with the expansion of the flue and door sheet transversely a short distance above the ring and loosens the corner rivets and the calking, and is the main factor in the breaking of the sheets at the top edge of the ring. The problem of how to prevent mud rings from leaking is a matter of providing for the expansion and contraction of the fire-box sheets.

I have found the double ring superior to the single so far as the leaks directly in the corners are concerned, yet while it accomplishes the desired results to some extent in keeping the corners intact, it is more severe on the laps and vertical seams adjacent thereto, and also more injurious to the flanges and sheets than the single ring on account of it being more rigid. To overcome the rigidity of the solid rings I have made a very successful experiment in the substitution of a copper flange for a ring, having applied it upon a consolidation locomotive with a 9 ft. box which has been in service almost six months and has not leaked.

By Mr. P. Sullivan, Foreman Boiler Maker, C., C., C. & St. L.

. . . My experience shows that a double row of rivets in the mud ring is a success and I would advise not less than 3½ in. sides and back water space and 4 in. front water space on account of double riveted mud ring being so rigid; this allows more water space and keeps the sheets from corrugating.

Report of Sub-Committee.

The prime cause of mud rings leaking is the unequal expansion and contraction, and we would recommend that the sheets be fitted solidly into the corners; rivet holes to be placed as near the corners as practicable, and countersunk, and the rivets driven upon the inside. The mud rings should be made for double riveting, with corners extended down to allow an additional row of rivets in the corners. The ring should be made of No. 1 hammered iron with turned corners, and welded on the sides or ends. The report is signed by Messrs. W. H. Laughridge, W. H. Shaw, William Krum, John McKeown, H. Denzler.

CRACKING OF FIRE-BOX SHEETS.

By Mr. W. W. McCoy.

I have seen a number of cracked side sheets where I knew it was not from mud burns. Sometimes in isolated cases I think it may be due to lamination originally in the sheet, but generally I believe it due to excessive strains in sheets that have not had the proper chemical or physical properties.

The remedy is: First.—To get steel of a better quality. Second.—Greater water space. Third.—To remove chances of undue strains as much as possible.

Concerning the physical qualities of steel, my experience has made me believe that steel companies are making steel to sell, and are not over-zealous as to quality: just so they get rid of it. Am also of the opinion that much poor fire-box steel is due to improper handling when rolled.

I believe all fire-box steel should be carefully annealed, not with a wood fire, but in an oven made for that purpose, so that the heat is uniform on all sides of the sheet, thus preventing checks due to coming in contact with the open air.

By Mr. M. Backes, Baltimore & Ohio.

The cracking of fire-boxes vertically is due to the expansion which takes place between the second and including the fifth row of staybolts above the grate bars, as there is no expansion in the water bar, for the reason that this part is quite cool. The expansion at the above named point is more rapid than at any other point in the fire-box, due to poor circulation. I have found these cracks running vertically between the vertical rows of staybolts as well as through the staybolt holes. This would indicate that the side sheets slightly bulge where the expansion takes place; and that there is little expansion below the grate bars.

By Mr. F. A. Batchman, L. S. & M. S.

The fire-box sheets give out at the lower portion of the

fire-box, just over the grates where the fire strikes the sheets, or the hottest portion of the fire-box, about 30 in. above the grates. To prevent the sheet from cracking we must have a larger body of water, I would suggest, about a 5 in. water space in the leg of boiler.

BEST METHOD OF WASHING BOILERS.

By Mr. Floyd Harris, Delaware & Hudson.

Washing boilers is a matter of great importance, as a boiler well washed will last a long time. The locomotives on the D. & H. system are culm burners, with several lump burning engines.

The system of washing boilers is as follows: The washout plugs are located so as to reach all parts of the boiler, with four handhole plates at the four bottom corners of fire-box and one 4 in. plug in the belly near the flue sheet. We first reduce the temperature of boiler, then wash out between throat sheets, then crown sheet, then between side sheets, then belly of boiler, and lastly between throat sheets again.

Plugs and handhole plates are then cleaned and replaced. Every three months we have our roundhouse boiler maker examine all boilers with a piece of lighted waste attached to a long rod, run through all parts of the boiler, and if any mud or scale is found it is loosened up immediately. The water along our division, between Albany and Binghamton, is soft and boilers do not require washing out more than once a month, or an average of 3,500 miles.

Our flues will last from 2½ to three years, and crown sheets will run 10 to 11 years before it is necessary to remove crown bars.

By Mr. Jno. Harthill, L. S. & M. S.

The L. S. & M. S. has a good method of washing boilers. In the first place, we get men that we can trust; this, I think, is the most important part of boiler washing. Next, we place the washout plugs so as to reach any part of the boiler. The 6 in. handhole plate we are putting on the belly of the boiler is a success, as it enables us to get the mud from the back flue sheet. It is placed about 24 in. from the throat sheet and is riveted on the inside of the boiler with $^{11}/_{16}$ in. rivets. We leave out two flues on the bottom, third row from center, to clear the exhaust base and steam pipes, and put in two 3½ in. plugs in boiler front, straight from plugs in flue sheet, so that plugs can be reached with box wrench. The water is forced between the flues the length of the boiler at a 60-lb. pressure. Four washout holes are on each side of the casing, even with top of crown sheet, one above the center of the boiler on both sides near the fire-box flue sheet; three on the back head over the crown sheet, and one over the fire-door. By placing the washout plugs in this manner, the mud is kept off the crown sheet.

Report of Sub-Committee.

The first and most important step should be the cooling down of the boiler. First blow off the steam. After the steam is off the water should be let out at a slow rate, and at the same time the cold water should be turned on, allowing the boiler to cool gradually. Under no conditions should it take less than one hour to cool down. Boilers should be well supplied with wash-out holes. A wash-out plug gives better service than a wash-out plate. There are so many different forms of boilers that the location of wash-out plugs should be left to the judgment of the foreman in charge.

Washing out through front-ends and boiler heads with long nozzle is recommended, and each boiler should be inspected after being washed. The report is signed by Messrs. John Gorman, Charles Letteri, Jos. McAllister, R. H. Davis, R. C. Young.

Steam Distribution of the Vauclain Compound Locomotive.*

The Vauclain locomotive is so well known that only a brief introductory description will be necessary.

The valve is really a combination of two piston valves, one formed by the outer or end rings which control the high pressure, and one formed by the inner or central rings which control the low pressure steam. For each cylinder the outer edges of the corresponding rings control the admission and the inner edges the exhaust. The steam from the high pressure cylinder exhausts to the opposite end of the low pressure cylinder through the hollow interior of the valve, which acts as an intermediate receiver. The live steam is admitted to the left hand end of the high pressure cylinder, while the steam in the right hand end is transferred through the valve cavity to the left hand end of the low pressure cylinder, and the steam from the right hand end of the low pressure cylinder is exhausted to the stack. The illustration shows the theoretical diagram constructed by Zeuner's method. At the foot of this plate is a table giving a summary of the phases of the expansion. Before going further it will be interesting to see how the diagram represents the processes through which the steam passes. In the high pressure cylinder, they are:

11-10. Admission of live steam.
10-12. Expansion in high pressure cylinder.
12-16. Expansion in high pressure cyl. and valve.
16-18, 18-13. Exhaust to low pressure cylinder.
13-17. Compression in high pressure cyl. and valve.
17-19. Compression in high pressure cylinder.
19-11. Pre-admission of live steam.

*By Lawford H. Fry. From the Baldwin Locomotive Works' "Record of Recent Construction," No. 42.

In the low pressure cylinder:

41-44. Exhaust to stack.
44-46. Compression.
46-48. Pre-admission from high pressure cylinder.
18-13. Expansion from high pressure cylinder.
13-45. Expansion in low pressure cylinder alone.
45-41. Exhaust to stack.

In the construction of the diagram Zeuner's method is employed in practically the same way as for a single expansion engine. Each cylinder is treated separately and the resulting diagrams are afterwards combined, to show them as they appear when both cylinders are indicated on the same card.

On the high pressure crank pin path the points are numbered from 0 to 9, and on the low pressure crank pin path from 20 to 29. For points on the high pressure diagram numbers from 10 to 19 are used, while for the constructional low pressure diagram the numbers from 30 to 39, and for the final low pressure diagram from 40 to 49 are used.

Having determined a suitable scale, the horizontal base-line 72-61 is laid off:

72-51. Represents the high pressure clearance volume.
51-58. The volume of the high pressure cylinder.
58-76. The volume of the valve cavity.
76-68. The low pressure clearance volume.
68-61. The difference between the volumes (areas) of the low and high pressure cylinders.

25. Release begins.
24. Compression begins.

Here, as also in the high pressure diagram, the inside lap is negative, and the exhaust and compression radii, N′-25 and N′-24, are therefore drawn as shown through the intersections with the circles G′ L′ N′, instead of through those with the circle N′ H′ M′, as would be done if the lap were positive.

The construction for the high pressure diagram is carried out in a similar manner, the same scale being used. To facilitate the combination of the two diagrams, the lap circles for both high and low pressure are drawn in the high pressure diagram.

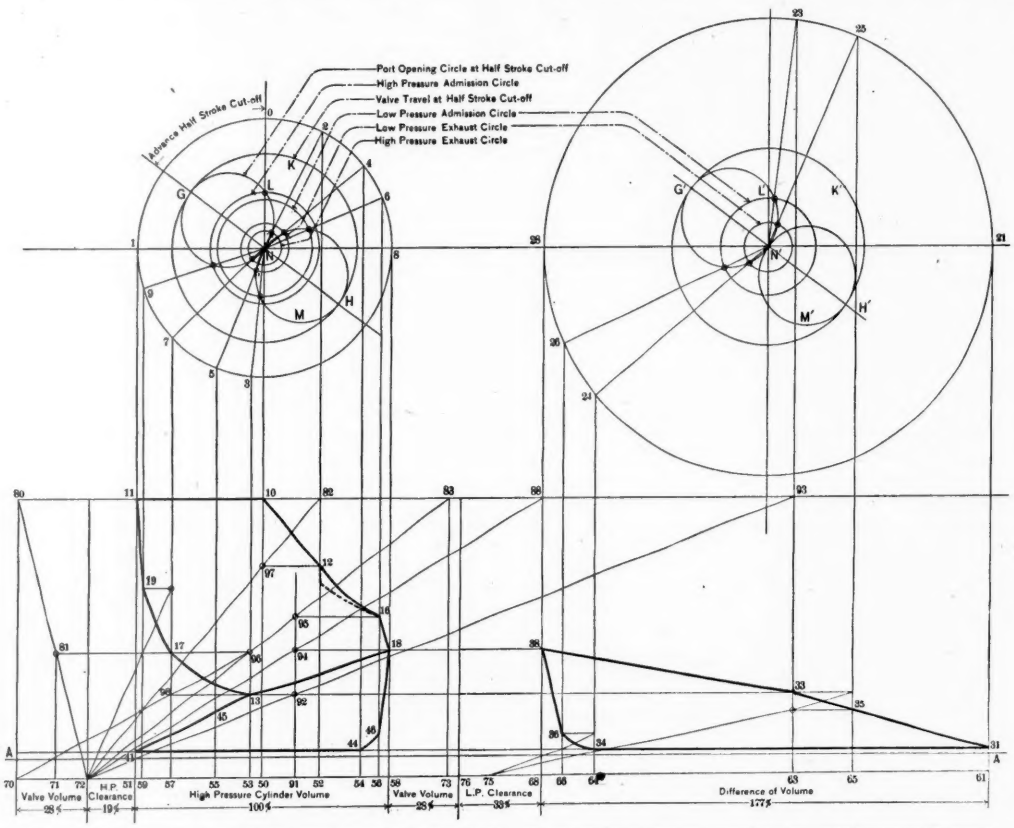
The periods of the steam distribution in both cylinders are determined by the radii through the various points of intersection of the circles, and it only remains to determine the changes of pressure throughout the stroke. It is assumed that the expansion and compression take place in accordance with Boyle's law:

Pressure × volume = a constant.

The expansion and compression curves are therefore equilateral hyperbolas and can be readily constructed by the methods ordinarily used for indicator cards. It is consequently not necessary to describe in detail the construction of the curves except in certain points where the special Vauclain valve introduces new features. For the rest a general description will suffice.

The base line 70-61 is taken as the zero line of pressure, and a suitable vertical scale being chosen for the pressures, the line A A is the line of atmospheric pressure, say 15 lbs. per sq. in., and the line 80-93 is the line of admission pressure, say 170 lbs. per sq. in. gage pressure, corresponding to a boiler pressure of 200 lbs. per sq. in. Assuming that no wire drawing takes place during admission, the initial pressure 51-11 is maintained constant along the line 11-10 until at half stroke the valve closes the admission port, and the admitted steam expands until the crank pin reaches the point 2, corresponding to the point 12 on the indicator diagram. The pressure at this point is found in the usual manner, the construction being shown in the figure. Before expansion the steam fills the high pressure clearance, and half the high pressure cylinder, its volume being represented by 72-50. This volume is expanded to that represented by 72-52, the pressure being found by joining 72 to 82 and through 97, the intersection of this line with 50-10, drawing a horizontal meeting 52-82 in 12. The required pressure is 52-12.

At the point 12 the interior of the valve and the high pressure cylinder come into communication, the interior of the valve being filled as previously pointed out, with steam at the pressure resulting from compression in the other end of the cylinder. To determine this pressure it is necessary to construct several indicator diagrams. In the first diagram the valve is assumed to be empty and the pressure at the point of closing of the valve is found by the construction explained below. For the second diagram the valve cavity is treated as being



ANALYSIS OF DIAGRAM.

HIGH PRESSURE CYLINDER.	LOW PRESSURE CYLINDER.
11 to 10 Admission of Live Steam.	41 to 44 Exhaust to Atmosphere.
10 to 12 Expansion in H.P. Cylinder	44 to 46 Compression.
12 to 16 Expansion in H.P. Cyl. & Valve.	46 to 18 Pre-admission from H.P. Cylinder.
16 to 18, 18 to 19 Exhaust to L.P. Cylinder.	18 to 13 Expansion from H. P. Cylinder.
13 to 17 Compression in H.P. Cyl. & Valve.	13 to 15 Expansion in L. P. Cylinder.
17 to 19 Compression in H.P. Cylinder.	15 to 41 Exhaust to Atmosphere.
19 to 11 Pre-admission of Live Steam.	

DATA.

	HIGH PRESSURE CYL.	LOW PRESSURE CYL.	VALVE.
Dimensions	15″ x 26″	25″ x 26″	11½″ Diam
Volume of Cylinders	9,850 cub. ins.	17,250 cub. ins.	2,750 cub. ins.
Clearance Volume	1,870 cub. ins.	3,250 cub. ins.	
Outside Lap	7/8″	3/4″	
Inside Lap (Negative)	1/4″	3/8″	
Mean Effective Pressure	86 lbs. per sq. in.	85 lbs. per sq. in.	
Mean Piston Thrust	15,200 lbs.	17,200 lbs.	

Steam Distribution of Vauclain Compound Locomotive.

When the cylinders are in communication the forward movement of the pistons adds to the volume an increment proportional to the difference between the piston areas. For this reason 68-61, the base line for the low pressure diagram, is made proportional to the *difference* between the cylinder volumes and not to the whole low pressure cylinder volume. In the present case the low pressure cylinder has a volume 2.77 times that of the high pressure, and consequently the line 68-61 is made 1.77 times as long as the line 51-58.

The line 1-21 being taken as the center line of the Zeuner diagram, the circle 28-21 represents the path of the crank pin for the low pressure diagram, and 1-5 the crank pin path for the high pressure diagram. Round the centers of these crank pin circles, Zeuner diagrams are drawn in the usual way. The construction can be best seen in the low pressure diagram which is drawn singly. The admission and exhaust circles are drawn about the center of the crank pin path, with radii respectively proportional to the outside and inside lap. The circle G′K′H′ is drawn with a diameter proportional to the valve travel for half stroke cut-off in the high pressure cylinder. The diameter G′N′H′ is drawn making the angle G′N′L′ equal to the angle of advance for this cut-off, and the port opening circles G′L′N′ and N′M′H′ are drawn on G′H′. Then by drawing radii through the intersections of the circles, the following crank pin positions are determined:

26. Admission to the low pressure cylinder begins.
23. Cut-off takes place and expansion begins.

full of steam at the compression pressure found from the first diagram. By constructing the second diagram a compression pressure is found which is greater than that of the first diagram, and which is taken as the initial pressure in the valve for the third diagram. The third compression pressure is found to be higher than the second and is taken as the fourth initial pressure in the valve, and this process is repeated until the difference between the successive compression pressure becomes negligibly small. This having been done the pressure at the time of closing of valve is found to be 57-17. Then at the point 12 the high pressure cylinder, containing a volume of steam 72-52 at the pressure 52-12, is put into communication with the valve, containing a volume 58-76 at the pressure 57-17, and this total volume of steam expands until the crank pin reaches the position 6, corresponding to point 16 on the diagram. If the opening of the valve and the movement of the steam were instantaneous the change in pressure would follow the broken line between 12 and 16, showing a sudden drop on the opening of the valve at 12 and then a gradual expansion to 16, but in reality this sudden change does not occur and the actual expansion is best shown by the full line 12-16. To determine the resulting pressure at the point 16, an auxiliary construction is necessary. The volume of steam in the valve is reduced to the equivalent volume at the admission pressure, 51-11. This is added to the volume of steam originally admitted and the expansion curve determined for the total volume. To determine the equivalent volume, 70-72 is laid off representing the valve volume, and 70-80 representing the admission pressure, 72 and 80 are joined and a horizontal is drawn through 17 to meet 72-80 in 81, which is projected onto the base line in 71. Then in the similar triangles 80-70-72 and 81-71-72, 80-70 and 81-71 represent respectively the admission and valve pressures, so that since 70-72 represents the valve volume, 71-72 must represent the equivalent volume at the admission pressure, since the volume is inversely proportional to the pressure. Then 50-91 is laid off equal to 72-71, so that the total volume of steam at the initial pressure is represented by 72-91, comprising the high pressure clearance 72-51, half the high pressure cylinder 51-50, and the equivalent volume 50-91. At the crank pin position 5, point 16 on the diagram, this is expanded into the volume 72-73, made up of 72-51 the clearance, 51-56 the volume swept by the piston, and 56-73 which is laid off equal to the valve volume. Hence the pressure is found by joining 72-83 and through 95 the intersection with 91-95 (the line of initial volume) drawing a horizontal to meet 56-16 in 16.

From here to the end of the stroke the two cylinders are in communication through the valve and the pressure is equalized out. The volume of steam left in the low pressure cylinder is so small that it may be neglected and the pressure at the end of the stroke is that due to the original volume of steam 72-91 expanded into the volume 72-68, comprising the high pressure clearance 72-51, the high pressure cylinder 51-58, the valve 58-76, and the low pressure clearance 76-68. The construction for finding the pressure 58-18 is shown, but as it is exactly similar to those previously described, it need not be followed in detail.

The steam now admitted to the low pressure cylinder expands as the pistons make the return stroke. This phase of the expansion is illustrated by the diagram on the right hand side of the figure. It is assumed that the steam passes from the high to the low pressure cylinder without loss of pressure, so that the initial pressure 68-38, of the low pressure is the same as the final pressure 58-18 of the high pressure cylinder. At the beginning of this return stroke the cylinders contain steam of a volume represented by 72-68 at a pressure 68-38, and as the pistons advance this steam expands between them until with the crank pin at 23 the valve closes the low pressure steam port. As explained above, the crank pin circle for this low pressure diagram has been drawn to a scale so chosen that the horizontal projection of the crank pin travel is proportional to the corresponding increment of volume when both cylinders are in communication. Consequently the increment of the volume during this portion of the stroke is represented by 68-63 so that the volume 72-68 (originally the volume 72-91) is expanded to the volume 72-63. The resulting pressure is found by joining 72-93, and through 92, the intersection with 91-95, drawing a horizontal meeting 63-33 in 33. Then 63-33 is the pressure required. During this period of expansion the cylinders are in communication, and hence the curve which appears in the low pressure diagram as an expansion curve must appear in the high pressure diagram as a curve of back pressure. The curve 38-33 is transferred to the high pressure diagram as the curve 18-13, the vertical scale remaining the same and the horizontal scale being reduced in the proportion of 51-58 to 68-61 (1 to 1.77). In the figure the line 18-13 has so slight a curvature that it is hardly distinguishable from a straight line. After the closure of the low pressure steam port at 13, the advancing high pressure piston compresses the steam left in the high pressure cylinder the high pressure clearance and the valve, until the high pressure exhaust port is closed at 17. To determine the resulting pressure at 17, the distance 72-70 is laid off to represent the valve volume so that 70-53 represents the volume of steam which is compressed to the volume 70-57. Through 13 a horizontal is drawn meeting 57-17 in 98. A line is drawn through 70 and 98 and produced to meet 53-96 in 96, and a horizontal is drawn through 96 meeting 57-17 in 17. Then 57-17 is the pressure at the end of the preliminary compression. At 17 the valve closes the high pressure exhaust port (leaving the valve filled with steam at a pressure of 57-17) and until pre-admission takes place at 19, the steam retained in the high pressure cylinder and clearance is further compressed. The volume 72-57 is reduced to the volume 72-59, the pressure rising from 57-17, to 59-19. This pressure is found by a similar construction to that just used to find the pressure 57-17, but since communication with the valve cavity is cut off the point 72 is taken as the origin instead of the point 70. It will be seen from this construction that the compression in the high pressure cylinder can be reduced by increasing the volume of the valve cavity. At the point 19 live steam is admitted and during the remainder of the stroke the pressure rises to the initial pressure 51-11. This completes the cycle in the high pressure cylinder and it only remains to follow the steam in the low pressure cylinder from the point at which cut-off occurred.

From 33 to 35 the steam confined in the low pressure cylinder and clearance expands. It must be noted that since communication with the high pressure cylinder is closed, the expansion takes place into the whole volume swept by the low pressure piston, there being no reduction of volume by the movement of the high pressure piston, as was the case when both cylinders were in communication. To allow for this 68-63 is taken to represent the initial volume of steam in the low pressure cylinder and 63-65 the increment of volume as the crank pin advances to the point 25 at which release takes place. These volumes are on a scale which is to the scale of volumes hitherto used, as 1.77 is to 2.77, so that it is necessary to reduce in this proportion the line representing the low pressure clearance volume; this is now represented by 68-75, instead of by 68-76. Then the volume 75-63 is expanded to the volume 75-65, the pressure falling from 63-33 to 65-35, which latter is determined by the same method previously used for finding the other pressures.

At 35 the exhaust to the stack is opened and the pressure falls as the piston advances, reaching 61-31 at the end of the stroke. During the return stroke to the right, which really corresponds with the stroke first investigated in the high pressure cylinder, the steam is exhausted at the constant back pressure 61 to 31 until at 34 the valve closes the exhaust port and compression begins. The volume of steam retained in the low pressure cylinder is represented by 68-64. As the low pressure cylinder alone is concerned the clearance is represented by 75-68 so that the total volume of steam in the cylinder and clearance is 75-64 which is compressed to the volume 75-66, the pressure rising to 66-36, which is found in the manner described for the high pressure compression. At 36 the valve opens communication between high and low pressure cylinders and as the stroke ends the pressure rises to 68-38 as seen above. This completes the cycle of admission, expansion and exhaust.

Then in order to have both diagrams together, the low pressure diagram is transferred from where it is constructed to a position below the high pressure diagram. In doing this the scale of pressures remains unaltered while the horizontal scale of volumes is reduced in the proportion of 1 to 1.77. The combined diagrams are shown on the left of the illustration. In integrating such a pair of diagrams to determine the power developed, it must be remembered that the steam pressures shown in the low pressure diagram act on an area 2.77 times that of the high pressure piston. It is found from actual diagrams that the work done in each cylinder is practically the same.

It will, of course, be understood that the foregoing construction is based on the assumption that the valve opens and closes the ports instantaneously. In actual indicator diagrams the gradual opening and closing of the ports give rounded corners instead of angles as shown in the theoretical diagram. At high speed wire drawing during admission will be observed, and owing to the friction of the steam in the ports the expansion line of the low and the back pressure line of the high pressure diagram will not coincide.

British and American Industrial Conditions.

Mr. Alfred Mosely's commission of 23 trade unionists, selected as representing the more important British industries and sent to the United States to observe conditions here, has sent in its report, which is reviewed by the *Statist* (London). The commission contained an engineer, a cotton spinner, a book binder, a compositor, an iron and steel worker, a carpenter and joiner, a boilermaker and iron shipbuilder, a plasterer, a papermaker, a tailor, a boot and shoe maker, a lithographic printer, a leather worker, an ironfounder, a bricklayer, a blast furnaceman, a shipwright, a weaver, and one representative each, of the Sheffield trades, the furnishing trades, the London Trade Council, the Trade Union Parliamentary Committee, and the Midland Counties Trades Federation.

One important question asked of the delegates was, "Does the American workman do more or less in an hour, on the average, than the English workman?" Mr. Mosely's own conclusion is that the true-born American is a better educated, better housed, better fed, better clothed, and more energetic man than his British brother, and infinitely more sober—"as a natural consequence he is more capable of using his brains as well as his hands." But this conclusion is not generally endorsed by the delegates, who do not admit that the American workman is himself a better producing agent than the British. Report after report notes that there is little or none of the "hustling" which has sometimes been described as a characteristic of American workshops, and in some cases it is stated that the men do not work any harder than, if so hard as, in this country. But Mr. Maddison says: "I have come to the conclusion that the American moulder turns out something like 25 per cent. more work than the English moulder; 10 per cent. may be said to be due to extra effort, and other 15 per cent. to better facilities."

Mr. Hornidge says that, so far as he saw in the boot factories, the American does more in an hour than the English, and, speaking of one particular factory, remarks: "It must be considered that all who were working in connection with machinery were working as hard as possible—not in the sense that one could see them sweating or straining, but the machinery was running at the highest speed, and the operators—to make use of a Yankeeism—had to keep their eyes skinned and their fingers at work. . . . The workers in a general way worked enormously hard, particularly the lasters and finishers. It may be that the atmosphere, which is very bright and exhilarating as compared with our own, might have something to do with what I look upon as their natural rush."

The delegates generally acknowledge that more machinery is used in America, and many of them think it is run at a higher speed. As to steel manufactures, Mr. Cox says the leading American mills are "far ahead of our own best mills in their arrangements and outputs," and, with reference to the Edgar-Thomson works at Braddock, he remarks: "It is almost impossible to overstate the arrangements of these mills, the perfect despatch with which everything is done, and the incredibly small amount of manual labor required, in comparison with our own mills. Everything is straight and continuous. Not only are the mills well fed, but such is the space and equipment that there is no hitch or block through to the finish."

Another of the questions asked was: "How is it that the American manufacturer can afford to pay wages 50 per cent., 100 per cent., and even more in some instances, above British wages, and yet be able to compete successfully in the markets of the world?" Mr. Mosely believes that it is the extra speed at which machinery is run; the high specialization of work, whereby each man becomes an expert in his particular branch, which in itself means efficiency and an increased output; the economy of hands in attending machines, and the excellent organization of the factories, whereby the smallest items of time and labor are saved, that make all the difference between large profits and none, and a high rate of wages for the men as against the comparatively low standard known in this country. Some of the delegates say that the tariff must be taken into account. The vastness of America's natural resources is, however, the reason commonly put forward for her industrial success, and the feeling is expressed by some of the reporters that these resources will make her difficult, if not impossible, to compete with in foreign markets. Mr. Barnes says: "I believe that, while retaining our own superior characteristics of thoroughness, and while continuing to have regard for certain standards of life and conduct, we might, nevertheless, follow the lead of the Americans in encouraging inventiveness and initiative, in fully utilizing machinery, and perhaps in organizing industry on a larger, and therefore cheaper, scale." In shipbuilding, also, Mr. Cummings and Mr. Wilkie both think Great Britain can hold its own, but the majority of the delegates do not directly discuss the relative positions of the two countries at all.

With regard to the specialization and sub-division of labor in American factories, several delegates acknowledge that it is a factor in increasing productiveness; but some of them think it has disadvantages also, and suggest that one of the reasons why so many men of English and Scotch birth are to be found occupying responsible positions in American works is because the training they have received makes them "all-round" men, with a general knowledge of their trade. The American system, they say, produces men whose capabilities are limited to a very narrow range. Mr. Barnes says that the American specialist "gets on the whole less overlooking, because he requires less. He is confined to a ceaseless repetition of small operations, which have no room for initiative individuality; in short, he is in a deep and narrow groove, in which he cannot go wrong, and, so far as I had opportunity of forming a judgment, he is just the timid invertebrate that might be expected as the outcome of such conditions. In so far as increase of goods is obtained through 'producing' this type of 'producer,' it is an increase which I think is too dear at the price. I should like, however, to discriminate here between specialist and specialist. In so far as specialization is brought about by improved machinery, rendering operations more simple or automatic, it is inevitable and legitimate that such operations should pass from skilled to unskilled hands—that is to say, from the hand mechanic to the machine operator or specialist. But there is another form of specialization, viz., that brought about by simple division and sub-division of processes, and the allocation of parts of each to specialists working under the control of contractors and gang bosses, and called upon to exercise a certain set of muscles in a mechanical way day by day. It is to the latter form of specialization that I object."

While there is a general disposition among the delegates to deny that the workman in America expends more energy on his work than in Britain, it is admitted that the production per man is greater, the difference being attributed to better workshop organization, increase of

labor-saving machinery, and also to worse quality of product. Mr. Taylor is of opinion that the average output of the bricklayer in America is greater than here, but he maintains that American bricklaying is so different in character, and generally so much rougher, that to make a proper comparison is very difficult. Mr. Deller says the American plasterer "undoubtedly covers more ground than we in England do, but the quality is very inferior." His report complains of the badness of the work and of the conditions under which it is carried out. At the Post Office at Buffalo, he says, there is "plenty of plastering of fairly good design, but executed in such a manner as to make it a standing disgrace to the trade." Mr. Barnes notes that "American workmen are more favorably disposed towards machinery," and he suggests a freer use of machinery and the latest appliances as points in which we should follow American practice. The greater output of American factories he believes to be "almost entirely due to more machinery compared with hand work"; though he also says that to some extent a greater speed is run, because of the softer material and the use of the best steel for cutting. Of the manufacture of paper for newspapers Mr. Dyson says: "In the mill there is no doubt we are also lagging behind, the mechanical equipment of the American mills being superior to the great majority of the mills in this country, not only in the machinery actually necessary for paper manufacture, but for labor-saving also. The idea of the American is, from the time the raw material enters the mill, to get as much of it made into the finished article in the shortest possible time, everything necessary in its manufacture being regulated by this desire."

Electricity in Railroad Shops.

The following letters from prominent motive power officials have been received in answer to inquiries regarding the use of electricity for driving machine tools in railroad shops.

LETTER FROM MR. F. D. CASANAVE, GENERAL SUPERINTENDENT OF MOTIVE POWER OF THE BALTIMORE & OHIO.

The use of electricity for driving machine tools can only be settled intelligently by those who are familiar with the shop requirements, and other conditions which affect the character of the work. Without such knowledge, and the exercise of good judgment, its use may be unprofitable. In our own experience it has been found more desirable to operate a certain group of tools by electricity, the power being applied to the main shaft. In the case of heavy tools, the use of which is not continuous, it has been found more profitable to use separate motors. By this time, everybody, I presume, has learned the advisability of discarding weak tools, and substituting for them others capable of materially increasing the output, and after that has been done, the advantages or disadvantages of driving them electrically, as stated before, is a matter of judgment and experience.

Electricity has advantages in the following particulars: It permits closer and wider range of speed regulation, also better distribution of tools, and better utilization of shop space, also saving in power when any number of machines are only used spasmodically, saving in shafting and shafting supports, which means, of course, less obstruction to light, and more head room for any other appliances that might be used conveniently to handle materials in each shop.

LETTER FROM MR. A. E. MANCHESTER, SUPERINTENDENT OF MOTIVE POWER OF THE CHICAGO, MILWAUKEE & ST. PAUL.

We have outgrown our older shops and power station and are just now in the midst of rebuilding, putting in a detached power station and preparing to operate our shops electrically. The bulk of our work will be done by grouping, though many of our important and heavy tools will be individually driven.

LETTER FROM MR. B. JOHNSON, SUPERINTENDENT OF MACHINERY OF THE MEXICAN CENTRAL.

The use of electricity for driving machine tools is most interesting, and I am inclined to agree with the views which you express. I have given much attention to the investigation of results in this line for four years and must say that I do not believe the gain is as large as I had been led to believe by the general statements made by its advocates.

LETTER FROM MR. T. W. DEMAREST, SUPERINTENDENT OF MOTIVE POWER OF THE PENNSYLVANIA LINES WEST OF PITTSBURG, SOUTH WEST SYSTEM.

The entire question is a very interesting one, the office of a shop being to furnish such facilities that the work of repairs may be accomplished in the shortest possible length of time and at a minimum expense.

Our personal experience with the electric motor drive has been very limited indeed, and while we have adopted it as the most desirable method of driving our machine tools in our shops at Columbus, we have not as yet had experience with its operation. We have, therefore, in laying out the machine tools and the motors, adopted the group system with very few exceptions, with the idea that as we obtain experience we will make a further separation of the tools. In other words, we will have to ascertain the maximum point of economy in the application of the motors.

With the present method of machine tool driving, there are many tools which are not rigid enough to withstand the strains placed on them by the speeds and feeds capable of being obtained from the modern self-hardening steels, and there are still fewer of these tools which will pull the cuts which it is possible to obtain from the tool steel. The use of such specially constructed tools is not, in our judgment, generally economical, from the fact that the character of the work done at the shop should be taken into consideration. A distinction should be drawn between shops which operate generally on new work, or construction work, and a shop whose output is confined to maintenance work or repair work. In the former case there is usually a duplication of heavy parts requiring a large removal of stock, in doing which the heavy powerful machine tools are advantageous. In the repair or maintenance shop, however, the machine tools which are operated on new parts are confined principally to castings or smaller forgings, on which, as a rule, there is very little excess stock. With the exception of a few tools, we cannot in our opinion, obtain the advantages from the modern self-hardening tool steels which it is possible to obtain from them. The notable exceptions are driving wheel-lathes, steel tired wheel-lathes, and horizontal mills for tire boring or turning purposes. Axles of all kinds are usually furnished rough turned, which disposes of the heaviest forgings, aside from the frames. On the other hand, there is a class of machine tools, such as turret head lathes (which are a necessity in any shop) and which should be made more rigid and powerful. We expect later on, i.e., as soon as our method of driving our machine tools is changed, to go into the subject more in detail, and expect to obtain some data which will be generally interesting.

There is a still further advantage in the motor drive which does not appear in the ordinary method, that is, the possibility and ease of obtaining variable speeds. This is particularly apparent on vertical mills, in which there is a wide variation in the cutting speed of the tool as it is moved inward towards the center of the table. The ease with which such variation is obtainable in a mortar particularly recommends it. This speed variation is also advantageous to some extent in planers.

LETTER FROM MR. G. R. HENDERSON, SUPERINTENDENT OF MOTIVE POWER OF THE ATCHISON, TOPEKA & SANTA FE.

I believe the principal advantage of the new tool steel lies in the fact that we can remove metal at higher speeds. The old machinery will not stand a heavy cut such as can be taken by the new tool steel if operated at a low speed, but if we can keep the same depth of cut and feed but increase the speed it is possible to remove more metal without putting any additional strain upon the machine, and electric motors enable us to adjust this speed more nearly to the needs of the size of the part to be handled, particularly in the case of planers.

LETTER FROM MR. WM. GARSTANG, SUPERINTENDENT OF MOTIVE POWER OF THE C., C., C. & ST. L.

We have not had a very large experience in this line and are not as enthusiastic as some of our friends. On the other hand, we have enough motor driven machines and appliances to get a very fair idea of the general results. I consider that we experience the greatest comfort and make the largest saving by motor drive on turntables, transfer tables and traveling cranes.

We only have the individual drive on a number of large tools that are in operation under the traveling cranes, and in buildings some distance from the engine. From the experience so far, I question if we get any more work out of the machines than would be the case with the belt drive. The machines that have the individual motor drive have not given us any trouble and the cut is kept up constantly, without the slip that will sometimes occur with belts. I also think there may be a small saving in time due to starting and stopping, but these differences are very slight. It is probably safe to say there is no gain when the cost of the motor and its maintenance is taken into account.

A large saving is made, however, in the operation of turntables, transfer tables, heating and ventilating fans, and tools remote from the machine shop proper by the use of motors. Our boiler shops have the tools driven by motors, some on a line shaft with motor at one end and some with individual drive. The individual drive is used almost exclusively where the machines are set near the center of the shop and where belting would interfere with cranes or trolleys overhead. I am satisfied from a point of economy that the light tools can be more cheaply operated by belting from the line shaft than by individual motors, whether the line shaft be driven by a motor or an engine.

The repair work which constitutes practically all of the work done in the ordinary railroad shop, does not give the same opportunity to work the tools at their maximum capacity as the contract shop, and for this reason there are comparatively few tools displaced before they are worn out, to make a place for others of the same size, but with greater cutting capacities.

There is also some question about the advantages by very high speeds. Some recent tests showed that a moderate speed with heavy cut is better than higher speed with a lighter cut. This is particularly the case in tire boring and turning, the best air hardening steel and a powerful lathe being used. In ordinary railroad shop practice where it is very seldom possible to take an extremely heavy cut due to forgings and castings being made nearly to size or rough turned, and where the belt will pull all the cut that the stock requires, I am not a believer in the motor drive when the machine can just as conveniently be belted to the line shaft.

LETTER FROM MR. L. H. TURNER, SUPERINTENDENT OF MOTIVE POWER OF THE PITTSBURG & LAKE ERIE.

We are building what we expect will be one of the nearest up-to-date repair shops in the country. All tools will be individually motor driven, except a very few small ones which will be grouped. We are using motor drives because we believe it to be the best, but not until our shop is completed and the tools in actual operation will we be able to make any statements which cannot be questioned.

LETTER FROM MR. G. W. WEST, SUPERINTENDENT OF MOTIVE POWER OF THE ONTARIO & WESTERN.

I have given some attention and considerable thought to the subject and have visited several shops that are operated by electricity, and am satisfied that there are several advantages in the use of electricity for driving machine tools over past methods. At the same time I am not as enthusiastic on the subject as a great many men. In the first place, I have considerable doubt about the increased economy that is claimed by advocates of the electric drive over belt driven machines. The comparative statements that have been furnished for the opinion of the public have been very unfair. Most of them have compared the modern shop fitted with modern tools with an abundance of power, using steel adapted for high speed, with an old shop with low roof trusses, short driving belts and tools that would not show any more output driven by electricity than by the belt and line shaft.

I have never yet met a man who was unbiased who was willing to say he could show any decided economy in the use of electricity, and I have not seen anything in print or listened to any argument that could substantiate the statement to the contrary.

There is no question but that we could get a lighter shop and better arrangement of tools driven by electricity than by overhead shafting, but I doubt very much whether a shop like the average railroad shop of to-day could be fitted up, using their old tools, with electricity, and produce an output that would warrant the change.

However, if I were called upon to fit up a new shop with new tools I would be inclined to use electricity on the greater number of tools for the convenience and benefit that might be derived from the better arrangement of tools and the better quality of work which ought to be produced by a man in a well lighted shop over a shop not so well lighted.

LETTER FROM MR. DAVID VAN ALSTYNE, SUPERINTENDENT OF MOTIVE POWER OF THE CHICAGO GREAT WESTERN.

In our Oelwein shop, which was one of the first of the so-called modern shops, the tools are all group driven, although we are now installing an individual motor to run our heavy wheel lathe. This was necessary because of the increase in power required to run the lathe with high speed steel. Aside from the wheel lathe we have done very little with high speed steel, although we are introducing it slowly.

LETTER FROM A PROMINENT MOTIVE POWER OFFICIAL WHO REQUESTS THAT HIS NAME BE NOT USED.

As I look at the subject of the application of electricity generally, it appears to me that very much of the work is prompted by the enthusiasm of the person making the installation, in just the same way that we have seen the indiscriminate application of air tools, and, occasionally, of hydraulic power, without the restraint which should be based on the limitations of the particular method of applying power.

It furthermore appears that much of the benefit from the application of electric power is indirect. That is to say, if the use of electric driving facilitates the use of overhead traveling cranes not otherwise admissible, there is legitimate reason for its use; and furthermore, by the use of electric driving a central power station can be installed, with the diminished cost which goes with concentrated working. The use of extended steam pipes is not only a source of loss in itself, but the liability of failure at an inopportune time may cause a serious loss.

I question whether the advantage claimed for motor driving of speeding each tool to the most economical speed, is in practice as profitable as would appear on the face. If it were the desire of all of the men operating tools to get from them the maximum output, I think the claim would be just, but as a matter of fact this does not seem to be the case, and reliance must rather be placed on the efficiency of the foreman, to see that speeds and cuts are economically chosen.

The endeavor to secure increased output from existing tools has shown that the substitution of improved cutting steels is but a small part of the problem. It is evident that these tools have not the rigidity to avail of the valuable properties of the new steels; this being more particularly true with such tools as driving wheel lathes, and doubtless equally true with most of the older machine tools.

It is not necessary to re-hash the old arguments as to the desirability of being able to run one or two isolated tools while the rest of the shop is idle, for power is, after all, one of the cheapest commodities of the shop. Economies in the modern shop are due to:

First.—Better facilities for handling material, due to the use of cranes, etc.

Second.—The conditions that make the shops more desirable for working; that is to say, better light, heat, etc.

Third.—The introduction of heavier machine tools capable of performing the work expeditiously,

Fourth.—The facility with which power is distributed electrically instead of by isolated engines.

Fifth.—The fact that errors in the original placing of tools, and the design of shafting to transmit power to such points, is subject to local correction by the application of motors at the points where additional power may be needed.

LETTER FROM A PRMINENT SUPERINTENDENT OF MOTIVE POWER WHO REQUESTS THAT HIS NAME BE NOT USED.

When we worked up the general plan of our new shops several years ago I decided that it was not safe in the present state of the art to go very deeply into the question of individually driven tools inasmuch as the key to the situation lay in the tool steel which would withstand the greatest punishment—this steel being the foundation of the design of any particular machine tool. In fact, within the last year we have experimented with certain grades of new tool steel and find it is possible to pull 2½ times as heavy a cut with this steel as with the grades formerly used. So, giving consideration to all questions entering into the individual machine tool drive proposition, I decided that the safe practice for to-day was to conveniently group the tools and motor drive each particular group, making a very flexible arrangement which can be changed to the individual group drive in easy stages.

LETTER FROM MR. E. D. BRONNER, SUPERINTENDENT OF MOTIVE POWER AND EQUIPMENT OF THE MICHIGAN CENTRAL.

At the shops at Jackson, Mich., we were running five different engine and boiler plants for power widely distributed. We also ran several other boilers for heating. In making our extensions to this plant it was desired to concentrate all these plants in one modern power house, to include a lighting plant for the shops, roundhouse, depot, freight house, yards, offices and other buildings belonging to the company. To do this we used electricity for power, including cranes, transfer-table and turntable. The machinery is grouped and the shafting is turned with motors. Individual motors are not used to any great extent, except in the case of some of the large machines which are used intermittently, or which on account of location could be driven more conveniently in this manner.

Economy in power or increase in output from machinery was not our main object. We had to increase our capacity and alter the old portions of the plant to put it on a modern basis, and concluded that under the conditions that prevailed, electric power would best meet the requirements.

In meeting the demands made by the large locomotives now in use and to reduce the cost and time required to handle all locomotives repaired or built, dependence will be placed upon improved machinery and tools, improved devices and methods and the better facilities for handling engines and parts.

LETTER FROM MR. J. F. WALSH, SUPERINTENDENT OF MOTIVE POWER OF THE CHESAPEAKE & OHIO.

Just at present we have no tools in our shops driven by electric motors; but we are contemplating installing electric motors in a shop extension at Clifton Forge, Va. The extension will consist of a planing mill, boiler and tank shop, and extension to the present blacksmith shop. Our idea is to put in separate motors for each shop, in order that they can be operated independently, but not to have individual motors for each machine.

In case the proposed electric drive proves satisfactory, machines in the present shop will be grouped and driven from short lengths of shafting and counters with possibly a few of the heaviest tools handled by separate motors.

The principal advantage of an electric motor drive lies in the easy varying of speeds, and this would only be of advantage where the tools are adapted to high cutting speeds.

In the present case the electric installation will compare favorably with any other form of power transmission, while the maintenance is not expected to be as much. The motors obtainable now are so well designed for durability that it is not expected that anything serious will occur in keeping them in good order.

Imperial Japanese Railroads.

During the year ending March 31, 1902, the Government Railroads of Japan worked an aggregate of 874 miles of line; an increase of 87 miles over the year previous. The government lines in Japan constitute a little over a quarter of the total mileage, though their earnings are somewhat higher in proportion, but the report makes no mention of the private lines.

Passenger mileage during the year amounted to 716,959,023; which comes to about 820,319 per mile of line worked. This figure is of interest as showing the extreme density of passenger traffic, comparing with about 91,000 passenger miles per mile of line in the entire United States; with 388,086 on the New York, New Haven & Hartford, the Boston & Maine and the Boston & Albany combined, representing 98 per cent. of the traffic of that group of states where it is most dense, and with 662,113 in Belgium, which exhibits the greatest passenger density of any continental country. The receipts from passenger traffis, on the Japanese state roads, were approximately $5,546,206 (taking the value of the *yen* as 50 cents), which gives the average rate as about 8 mills per mile. Only about 1 per cent. of the total number of passengers carried traveled first-class, and less than 10 per cent. traveled second class.

Freight traffic was considerably less profitable than passenger traffic on the government lines, ton mileage being only 211,594,630, with gross receipts amounting to $2,406,468, or about 11 mills per ton mile. The average freight train load was 59 tons, and the average haul, about 84 miles. However, a table shows that the greater proportion of the freight hauled on most of the lines was moved less than 25 miles. Of the rolling stock, there were 1,634 "covered wagons," without brakes, of seven tons average capacity; 1,420 "uncovered wagons," without brakes, of approximately the same capacity; 451 brake vans, and miscellaneous, to a total of 5,061 revenue freights and 804 construction cars.

As compared with the year previous, there was a decrease in freight and an increase in passenger traffic. General industrial depression in Japan is blamed for the tonnage decrease, which was more than compensated, as regards earnings, by an increase in rates. The income account shows total receipts of $8,167,154; expenses, $3,968,943, and profits, $4,198,211. The capitalization is given as $60,661,919, which is at the rate of $69,407 a mile. In the mass of statistics which accompany the report, it is interesting to trace out that the highest paid native officer, the Director General, of the "Chokunin" (the highest) rank, receives $166 a month, whereas a "foreign employee" in the Director General's secretariat, though devoid of rank, receives $650 a month, or $484 more than his chief; which is harder to explain than some of the mysterious figures in Government bureaus at Washington.

Concerning the Location of Injectors.

In the discussion of Mr. Edwards's paper on injectors, at the May meeting of the Western Railway Club, several speakers urged the exercise of care in fixing the height at which the ordinary lift injector is to be placed All agreed that the most satisfactory location is on a level with the top of the tank. A lift injector cannot safely be placed lower than this, and if higher, the lift becomes unnecessarily great when the water level in the tank is lowered.

In attempting to illustrate the evils of too high a location, one speaker likened the work imposed upon an instrument thus placed to that of a man who is forced to carry material to the top of a hill, which is required for use half way up, the implication being that an injector which is located high has more work to perform than one which is set lower. A little consideration will show that the reasoning in this case is not sound. The mechanical work which is done by a locomotive injector depends upon three different factors, namely, the difference in water level in tender and boiler, the head equivalent of the pressure in boiler, and the head equivalent of the frictional resistance to the passage of water through the injector and its attached piping. Neither of these factors depend for their value on the height at which the injector is located, except in so far as the location may affect the length of piping, in which case the value of the third factor would be changed. But this is wholly a question of detail and not of principle. It does not necessarily follow that raising the injector increases the length of piping.

A change in the height of the injector, however, does change the distribution of work between the lift tube and the force-tube (or tubes). As the injector is raised, the proportion of the total work carried by the lift-tube is increased and that of the force-tube is diminished. If, therefore, the instrument gives more efficient results when it has but little lifting to do, it is evident that the efficiency of the lift-tube as an instrument for doing work, is less than that of the force-tube, and that in consequence, the performance of the combination of tubes making up the whole injector is most satisfactory when the lifting element is given as little to do as possible. The argument, therefore, in favor of locating an injector low is one which grows out of the characteristics of the instrument and is not in any way concerned with the problems in mechanics that are involved by its actions.

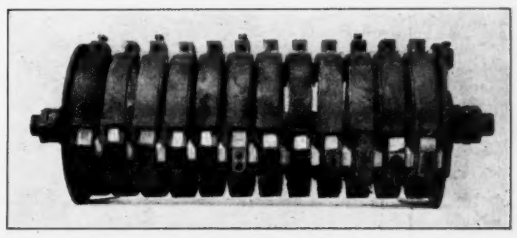
Foreign Railroad Notes.

The Russian authorities have announced a uniform tariff for special trains, at the rate of 60 kopeks per verst per car, not less than four cars being charged for. This makes $1.80 per train mile, very nearly. On those lines where express trains run an additional charge may be made if express speed is required. It is believed that parties of foreigners may not infrequently charter such trains for tours and excursions to the Pacific. Cook and Gaze will please take notice. (Doubtless they have done so already, and they may have been at the bottom of it all.) A circular tour among the chief places of European Russia (not omitting Kishinev) "personally conducted," might be very interesting to many who would not dare to venture on it without a courier.

A German newspaper published in St. Petersburg says that a very large part of the passengers on some Russian railroads do not pay for the passage, or at least do not pay full fare; the conductors often being too drunk to know whether they have taken up tickets or not, and oftener passing the passengers for a small consideration. In some cases the railroads have put on train auditors to check the conductors reports; but these usually have divided the spoil instead of checking the evil. In one case a train auditor who was supposed to make 14 trainmen honest, compromised with them for a monthly contribution of $7.50 each and let them have free swing.

Ventilated Cell Diverters.

In the "Ventilated Cell Diverters" made by the Westinghouse Co., the individual cells are separated, permitting a free circulation of air around each cell, and may easily be renewed if injured or worn out. Solid insulating blocks are placed between the cells, and solid insulating washers under the nuts at the ends of the columns.



The end of the resistance strip is brought out through a slot in the cell casting and connected to a boss by means of a washer and two screws, giving the contact great permanency and rendering it unaffected by long exposure to severe climatic conditions. The apparatus is compact and durable, arranged in several units for convenience in mounting, and adapted for all kinds of outdoor service, since no material of either a hygroscopic or a combustible nature is used in the construction.

Extension of Lehigh Valley Shops at Sayre, Pa.

The Lehigh Valley Railroad has adopted a plan for an extension of its principal locomotive and car repair shops at Sayre, Pa., re-arranging the use to be made of some of the present shop buildings and gradually, in the run of years, extending the system until the plant will consist of three groups of buildings, respectively for the repairs of locomotives, passenger cars and freight cars. The present intention is to build during the next two years only additional facilities for locomotive repairs. The work during the first year will consist mainly of preparing the site and erecting the principal buildings at a cost of about $1,000,000; the installation of the heavy work, such as the power plant, machinery, yard work, etc., will commence about a year hence.

The road now has nearly 800 engines to maintain with inadequate facilities. By concentrating all the heavy work at Sayre, the pits and facilities at the smaller shops will still be available.

The work to be done during the next two years will consist of the construction of a new main locomotive repair shop, 366 ft. x 749 ft.; a blacksmith shop, 103 ft. x 363 ft.; a store-house, 103 ft. x 363 ft., and a central power plant.

The main locomotive shop will have an erecting shop with 48 erecting pits, divided into an east and a west section, each section being 60 ft. x 627 ft. Between the two sections will be the machine shop, 156 ft. x 627 ft. At one end of the building will be the boiler shop, 121 ft. x 366 ft.

The machine shop will be divided into two bays, each 60 ft. wide, and a central bay 36 ft. wide. The central bay will have a gallery over it for the heating apparatus, toilets, lavatories, lockers, etc. The space under the gallery will be utilized for small machinery, benchwork, link and motion work, tool room, etc.

Between each erecting shop and the machine shop there is a 42 ft. x 627 ft. covered yard, to be used as an overflow storage ground for both the erecting and machine departments, for storage of dismantled parts and miscellaneous materials. Here will be located the storage pits, lye vats, tire shrinking platforms, etc. All locomotive repair work, with the exception of blacksmith and forge work, will be conducted in one large building with overhead cranes serving all important points.

The erecting shop is designed as a transverse shop with heavy overhead traveling cranes for transferring engines over others standing on the pits. This system corresponds to the practice of the most recently built large locomotive repair plants of the Philadelphia & Reading at Reading, Pa.; the Lake Shore at Collinwood, Ohio, and the Pittsburgh & Lake Erie at McKees Rocks, Pa. A similar system has been in use at the Baldwin Locomotive Works and at the Brooks Locomotive Works for about 10 years, and the same system has been recently installed at the Richmond Locomotive Works and the Paterson works. A modification of this system is in use by the Pennsylvania Railroad in the old machine shops at Altoona, where a heavy overhead traversing crane has been introduced in place of a transfer table.

The capacity of the overhead cranes in the erecting shop will be 120 tons on the upper level and 15 tons on the lower level. The overhead cranes in the machine shop and covered yard will have a capacity of 15 tons. All the cranes will extend into the boiler shop.

The details of the power plant and machinery have not been finally determined. All power and lighting will be by electricity. The machinery in the machine shop will be driven by a combination of individual and group drives.

The buildings will generally have concrete foundations, brick walls, steel frame and roof trusses, covered with slag roofing laid on armored concrete. The floors will be generally wood on concrete beds. In the higher grade buildings the top floor will be maple, in other buildings yellow pine. The blacksmith shop and part of

the boiler shop will have a cinder floor. Side windows will have plain glass and in the main locomotive shop factory ribbed glass. Roof lights and monitor lights will be wired glass. The heating of the main shop will be by a hot air blower system, the fans being run by motors and the heater units supplied with exhaust steam from the power plant. All other buildings will be heated by direct steam radiation. All pipes and main wiring will be conducted from the central power plant through an underground tunnel and ducts to the various buildings. Proper provision will be made for water supply, fire service, drainage, sewerage, sanitary arrangements, etc. The design, construction and equipment of the new shops will be in charge of Walter G. Berg, Chief Engineer, and H. D. Taylor, Superintendent Motive Power.

A New System of Rewarding Machine Shop Labor.

The following is an abstract of an article by Mr. H. L. Gantt, which appeared in a recent issue of *Cassier's Magazine*. The subject is interesting now because of the return to the old-time attitude of the labor organizations—in opposition not only to labor saving machinery but to economical methods of production. The subject is also interesting as an example of the efforts which employers are making to bring about a better understanding of the co-ordinate relations of each unit in shop systems.

The rapid development of steel would have been impossible without the chemical and physical laboratories, where the relation between chemical composition and physical quality could be carefully studied. Efficiency tests, made along strictly scientific lines, have for a long time been applied to boilers, engines, water-wheels, dynamos, electric motors, and the like, and all builders who ignore the scientific principles on which these machines are based soon find themselves out of the race.

Undoubtedly many other special machines are built that give high percentages of efficiency, but there is one very large class which is still built to a great extent without scientific consideration of the work that they are called upon to do. I refer to machine tools. While I do not pretend to say that tool builders are not making progress, I have seen within the past three years lathes from well-known makers that were quite unfitted for the work they were intended to perform.

I refer especially to machines for doing heavy work, and have in mind a so-called forge lathe, designed to rough-turn heavy forgings, and built with two very heavy carriages, each to carry two tools, but having such small pulling power that two tools in a heavy cut at the proper speed would tax the belt beyond its limit, making it impossible to use the four tools to advantage. The lathe is well made in other respects, and is used very successfully for finishing. I cite this example to explain what I mean, and might give others where the relation between feeds, speeds, and pulling power in an otherwise well-designed lathe is not such as to enable it to do as much work as ought to be possible with such a machine.

To make a machine tool which will do a maximum amount of work of a particular kind we must know what relation the feed, speed, and pulling power should bear to one another to produce that maximum. There is a mathematical answer to this question, but the number of independent variables is so large that its solution seems almost impossible. If it is to be solved at all, the solution must be preceded by a knowledge of the laws of cutting metals, about which at present little is generally known.

For instance, who can tell how much we must diminish the feed in taking a given depth of cut if we wish to double the speed and still have the tool last as long as it would have lasted if we had not doubled the speed? Again, suppose a deep cut becomes less on one end of a piece, at what decrease in depth can we increase the speed by, say, 20 per cent., without increased injury to the tool? Are the laws the same for different kinds of cast-iron, and for steel, and for different shapes of tools? Again, what pressure per square inch of chip section is needed to remove metal? How does it differ with different kinds of cast-iron and steel? I could go on asking questions of this kind almost indefinitely and feel sure that I could get but few definite answers; yet it is necessary to know all of these facts before a machine of maximum efficiency in cutting metals can be built.

Such facts are not easy to get. They are dependent upon so many conditions that to many the task of getting them appears hopeless. Even to devise a method of study is a problem beyond the power or patience of most men, but the writer is able to say that a start has been made, and so successfully that not only is the method of working entirely clear, but many valuable results have already been obtained. In 1880 Mr. Fred W. Taylor began to study the laws of cutting steel, and within the past four years the results of his work have been reduced to a slide rule system by the writer and Mr. Carl G. Barth and put into such shape that a fairly well-educated mechanic can use them successfully.

But little has been done with cast-iron, and while the writer does not pretend that all the laws regarding the cutting of steel are known, or that those that have been determined are known with absolute accuracy, he does maintain that enough is known to enable us to get very nearly a maximum amount of work out of a poorly designed tool and to give specifications for building a tool that will be a very efficient steel-cutting machine. The problem of designing a most efficient machine tool is one that especially interests the builder, while that of getting the most out of the tools he has, interests every man connected with a machine shop. It is almost impossible to realize the difference between the amount of work obtainable from a lathe rough-turning steel when run in accordance with the laws that have been determined and when it is run by the judgment simply of an ordinary, or even a first-class, workman. The increase in output is nearly always 100 per cent., frequently 300 per cent., and sometimes 500 per cent.

I can now imagine myself attacked by an army of machine shop foremen and not a few managers, who laugh at my Utopian ideas, and inquire as to the good of all this when they cannot get into the heads of their men the facts already known. Again, of what value is it to a man to know all this if he cannot be made to carry it out? He will not do it on day work, and if you set a piece rate, based on the figures given, you will have a strike at once. Yet this result has been, and is still being, accomplished by the "bonus system of rewarding labor," devised by the writer and first introduced under his direction in the large machine shop of the Bethlehem Steel Company. A full description of this was given by the writer in a paper read before the American Society of Mechanical Engineers in December, 1901.*

The substance of the system is that men working at day's wages receive, in addition to their regular wages, a substantial bonus for doing work in the manner and time prescribed. They receive full, detailed instructions as to how to perform each of the elementary operations on a piece of work with the time each should take, and as these instructions and times are made out from data known to be correct, the men soon see that they are asked to do only what is reasonable, and accordingly make efforts to earn a bonus. Such efforts are not always crowned with success at once, but the instructions are intended to be so definite that a man of very ordinary intelligence can learn to carry them out, and, with reasonable industry, can do the work in the time set. In order to make clear the subject of the instruction cards which are used, it is, perhaps, best that I quote a description of them from my paper above mentioned:

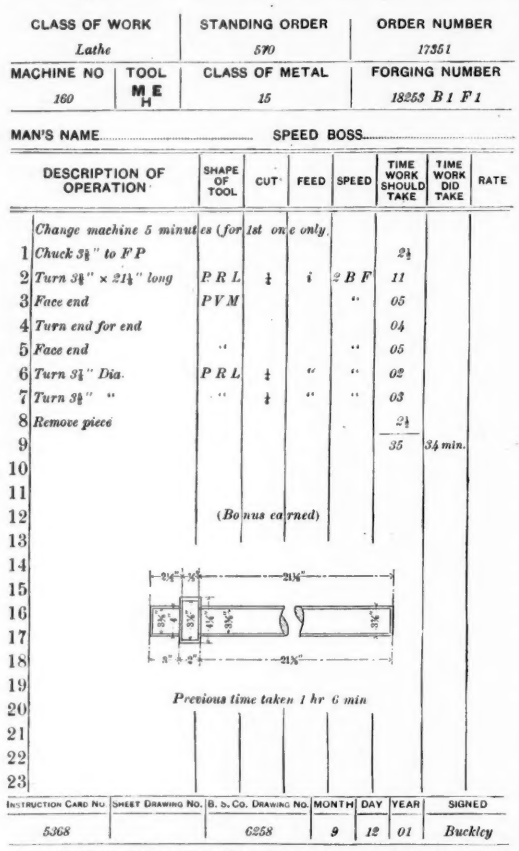


Fig. 1.—Card for Rough Turning a Locomotive Piston Rod.

The work to be done on a machine, say a lathe, is analyzed by a first-class machinist who has been instructed in the use of the slide rule, and who makes out a card on which the operations to be performed on this lathe are placed in the proper order, with proper instructions, the calculated time that is necessary for performing each operation being given. The kind of tool to be used, the feed, and the speed are specified for every machine operation. For every other operation, such as putting in and taking out work, laying out, changing feed gears, etc., instructions are given when necessary, and the time that each should take is placed directly opposite the instruction, in a column designed for that purpose. Fig. 1 shows a sample card for rough-turning a locomotive piston rod.

This card represents instructions given to William Jones, whose boss is Thomas Smith, to do work on Forging No. 14,653C4, Manufacturing Order No. 17,344, in Lathe No. 145, according to Standing Order No. 376. The hardness of the metal is represented by Class 12. He must use tools made of "*M. E.*" steel, of the shape designated in the column calling for shape of tool. The approximate depth of cut in turning is $^3/_{16}$ in.; "*J*" represents a combination of feed gears, and "*2-BF*" a cone-speed which he must use. Opposite each operation are seen complete instructions, given the kind of tool, cut, feed, and speed that must be used in order to accomplish the work in the time set. The total time for turning and facing this forging is shown to be 42 minutes.

Upon each of the cards are given, first its number, then the drawing number of the assembling sheet, if we have such a sheet; then the detail drawing for this particular piece, and next date and signature of the man who made out the card. The note at the bottom, namely, "When machine cannot be run as ordered, Speed Boss must at once report to the man who signed this slip," is put on in red ink, and should be observed to the letter.

By means of a card filled out from the slide rule, together with records of the time necessary to perform the miscellaneous operations, which for simplicity we shall call "hand work," a very ordinary man can be instructed in the best method of doing a piece of work. Considerable training, of course, is necessary to teach the men to follow these cards, but having once given them this training, the advantage of having a first-class machinist to do the thinking, and to use for them the best results already obtained, produces an efficiency which would be impossible if the workmen were left to themselves.

For further illustration I give Fig. 1 to show the difference between the ordinary day-work time and that needed with instruction cards and a bonus.

I now fancy the readers who have had the patience to follow me so far asking if all this pays, and my answer is to look at the results. The following cards give the time taken in actual cases to do the work both before and after the introduction of the instruction cards and the bonus system.

	Time needed.	
Card No.	Before.	After.
4811	54 hrs.	10 hrs. 50 min.
5613	5 hrs. 30 min.	1 hr. 50 min.
5368	1 hr. 6 min.	34 min.

The total time for the three jobs before the introduction of the system was 60 hours and 36 minutes, or 3,636 minutes. The total time needed after the introduction of the system was 13 hours and 13 minutes, or 793 minutes, which is 22 per cent. of the former time. In other words, the output of the lathe was increased nearly 400 per cent. While the examples here chosen are good ones, they are by no means exceptional; neither is the time for doing the work previous to the introduction of the system exceptionally long. Indeed, from what I have been able to see in many shops it was fully as short as the average for the same work. This possible gain settles in the mind of the writer the advisability of doing work this way, and we now come to the question of how to get the information needed to make out such instruction cards.

Each operation has to be studied by itself, not only to find the best time in which it can be done, but to determine the best method, and the time necessary to perform the elementary operations of which it is composed. In other words, each must be sub-divided into its elements, and each element made the subject of a scientific investigation. This would seem an interminable task, and it is indeed a long one; but when once the work is begun, the information accumulates with considerable rapidity, and, if properly catalogued and systematized, soon becomes valuable.

A careful consideration of the writer's paper previously referred to will show that while the method described of getting information is the ideal one, and to be approximated as nearly as possible, there is no reason why such information as is at hand should not be made use of at once by means of instruction cards, which latter afford the best available means of recording our knowledge of how to do work.

In every shop there is some man who knows more about the work than the others, and a start may be made by having him make out such cards as he can. A bright man, capable of careful observation, will soon improve his cards, and in a short time a start will have been made sufficient to show the desirability of modifying the shop management to such an extent that the system can be developed to a higher state of efficiency.

The instruction card system is the only means of which the writer knows by which anything like the full efficiency of the recent advance in tool steel can be taken advantage of, for men accustomed for years to one grade of tool steel cannot bring themselves up to the point of driving their machines three or four times as fast as has been their custom. When, however, the responsibility for the effect of the high speed is assumed by someone else and a bonus is offered for the result, the most stolid workman will gradually fall into line and reach for the bonus held out to him.

This brings us to the educational point of view, for while the workman is acquiring his increased efficiency, he is also receiving increased wages, and, if I have satisfactorily shown that it is to the interest of the employer to give the increased wages, it would seem that we have the basis of a system that works for the interests of both employer and employee. In other words, experience in the lines described has shown that the results of the scientific method are such that if an employer can have this method carried out, he cannot only pay for his experiments, but give his workman a liberal bonus for

*See *Railroad Gazette*, Dec. 13, 1901 and Dec. 12, 1902.

learning and doing what he has found out by his investigations. It would seem that such a system would have a tendency to produce harmony between employers and employees for their mutual benefits, and so far this has been found to be the case.

I have been asked what effect an improved tool steel has on the output of a shop, and have answered without hesitation that neither a new tool steel nor a new machine tool had any very appreciable effect unless steps were first taken to find out definitely what the new tool steel or tool would do, and then a system of management was adopted that taught the workman how to get out the maximum product, and made it to his interest to do so. This example seems to the writer a good summary of his paper, which may be further condensed into three heads, as follows: To learn, to teach, to reward performance.

If there be a science of management, and the writer believes that there is one, it certainly contains these three divisions as integral parts.

Further, these are general divisions, and applicable not alone to the machine shop, but to the forge and foundry, and, indeed, to any work performed by men and methods.

It is proper to add, however, that the introduction of any system of this type presupposes a time and record-keeping system by means of which exactly what every man and machine have done during working hours can be known. Of the various time-keeping systems the only one adapted to doing this in a satisfactory manner is the time card system, which, in its best development, not only gives the most accurate returns of time and labor, but does it with less clerical work than is usually expended on inferior systems.

The value of the time card is being gradually recognized, but few managers realize what a powerful economizing influence it may become if all its possibilities are utilized.

New Railroads in Southeast Africa.*

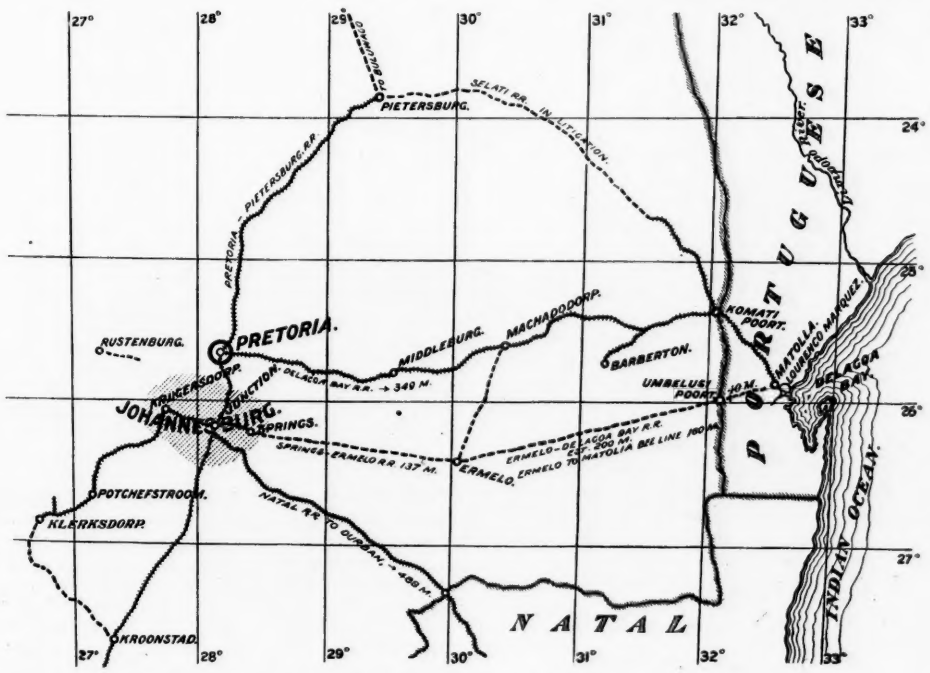
The construction of the Portuguese end of the Swaziland Railroad has been authorized, and the money has been appropriated by the Lisbon Government. The line has not yet been surveyed, but it will run from Matolla, a station 16 miles from Lourenço Marquez, on the Delagoa Bay Railroad, in a westerly by southerly direction to that part of the Transvaal just over the border, which is generally called Swaziland.

It is reported that the Transvaal Government has assured the Portuguese Government that this line will be continued from the frontier to Ermelo, a town 160 miles in a straight line from Matolla. From Machadodorp, on the Delagoa Bay Railroad, a private corporation is building a railroad line to Ermelo; and the Central South African Railway conference, at a meeting just concluded, has set aside the sum of $4,705,905 for the construction and equipment of a line 137 miles long connecting Springs, a station on the outskirts of Johannesburg, with Ermelo. Work on this line is to be immediately commenced. The old Delagoa Bay Railroad, between Machadodorp and Pretoria, passes through an extensive coal country, and the traffic along this section and to Pretoria and Johannesburg is now so great that the need of a parallel line is strongly felt. The Machadodorp-Ermelo-Springs line will relieve this congestion on the Delagoa Bay Railroad west of Machadodorp, and will give Lourenço Marquez another route to Johannesburg and to the adjacent districts.

The enclosed map of this part of the world shows the routes of the present lines and the approximate routes of the authorized lines. The vertical lines indicate the longitude east of Greenwich and the horizontal lines the latitude south of the equator. The completed and proposed parts of the Selati Railroad, which was to run from Komati Poort to Pietersburg, are also shown. This railroad is now involved in litigation. Rustenburg, shown on the map, is in the heart of a rich agricultural district, producing the best tobacco in the country. The Central South African Railway conference has allotted the sum of $2,433,250 for a railroad line connecting Rustenburg with the main lines; but it has not yet been decided whether it will connect at Pretoria or at Krugersdorp. The new lines will be practically parts of the Delagoa Bay system, radiating from Lourenço Marquez, and will find their principal employment in transporting imported merchandise from the port to important mining and agricultural centers in the Transvaal. They will also carry agricultural products from the outlying districts to the towns; coal from the mines to the centers of industry; and hides, wool, and coal to the coast. The natural increase of the trade of Lourenço Marquez is shown by the following statistics for the years 1901 and 1902:

	1901.	1902.
Imports from Portuguese countries.	$806,213	$1,156,893
Imports from foreign countries.	1,629,426	2,805,478
Imports in transit to the Transvaal.	4,707,116	8,274,276
Exports and re-exports	882,397	1,504,420
Coastwise trade	593,285	951,567
Total	$8,618,473	$14,692,634

*From Consular report to U. S. Government, by W. Stanley Hollis, Consul.



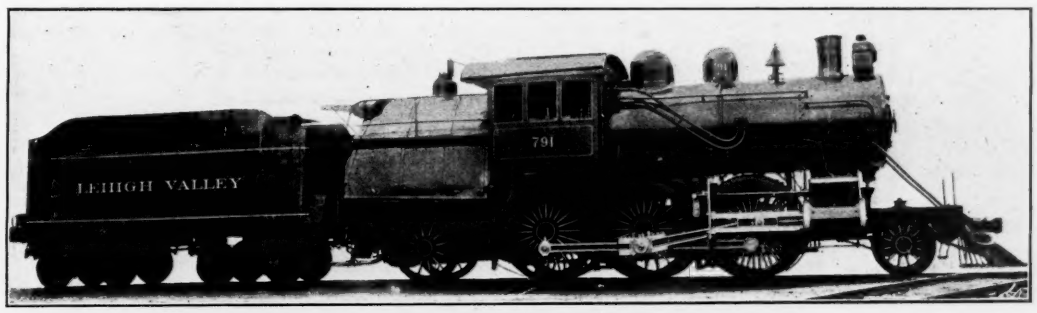
New Railroads in Southeast Africa.

British Railroad Earnings and Capitalization.

A preliminary summary of returns from the railroads of the United Kingdom for 1902, as compared with the two years previous, shows total gross receipts of £109,534,000, against £106,615,753 in 1901, and £104,858,723, in 1900. Total expenses in 1902 were £67,907,000; in 1901, £67,546,677, and in 1900, £64,800,385, leaving net receipts of £41,627,000, as against £39,069,076 in 1901, and £40,058,338. On the face of these returns, therefore, expenses have shown a less alarming increase, proportionate to gross earnings, than in this country. But the British system of keeping the charge out of earnings for maintenance down to a low figure, and issuing new securities to pay for improvements, is shown by the increase in total capitalization per mile of road worked. In 1900, with 21,855 miles open, this stood at the rate of £53,809 per mile; in 1902, with 22,147 miles, it was at the rate of £54,491. A marked improvement was made in the dividend paid by most of the British lines, for the last half year, after the scare in 1901, which indicates that these properties have not yet reached their limit of earning power. But with interest charges already very high, and increasing surely and steadily, year by year, without any compensating increase in the scope of the railroad system, the outlook for the future is not bright, and it seems inevitable that there must be some sort of retrenchment undertaken before many years.

Prairie Type (2-6-2) Locomotive for the Lehigh Valley.

The accompanying engraving shows a Prairie (2-6-2) type locomotive which has been used for about one year in hauling heavy fast passenger trains on the Lehigh Valley. The engine is simple and has displaced the somewhat heavier compound 10-wheelers originally used in similar service. The cylinders of this new engine are



Lehigh Valley Passenger Locomotive.

22 in. x 26 in. and the drivers are 76½ in. in diameter. The boiler contains 295-2¼ in. tubes, the total heating surface being 3,669.5 sq. ft., of which 212.8 sq. ft. is in the fire-box. The fire-box is wide and extends over the trailing wheels, and is 120 in. x 105¼ in. The driving wheel base is 13 ft. 6 in. and the total wheel base is 31 ft. 3 in. The tubes are 20 ft. long. It is said that these engines are giving satisfaction. They were built by the Baldwin Locomotive Works and are the design of Mr. H. D. Taylor, Superintendent Motive Power of the above road.

The Utility of the Dynamometer Car.*

The best school for railroad work is practice; but in scientific railroading what the laboratory explains is why certain things are done in certain ways. In this tonnage rating the old practice is to take an engine, get a train, and see how many cars it will pull up a hill loaded. The old way cannot be very reliable, for several reasons. In the first place, in fixing the tonnage rating under the old way, it was customary to get what was considered the best engineer. Now, we did that because we believe there is a difference in engineers, but it does not seem to me that we are always sure that we have got the best engineer. Some years ago, on the Burlington, it was proposed to take the test car and let the test car determine what tonnage the trains ought to pull up the grades. Myself and several other gentlemen connected with the mechanical department thought that was useless. We did not see how the car could help us in determining what the engineer and engine could pull up the hill, and nothing was done. I think that view was entertained on the Burlington road until last year, at which time we got the test car to go out on the B. & M., and we found that there was a very great advantage in having that car, because the laboratory took our different classes of engines and figured out how much those engines ought to pull up the grades. We put the test car behind the engine, and we weighed exactly what the engine was doing, and if the engine did not pull the load up to its tractive power we knew there was something wrong. On one or two occasions while we were making the test the engine was not doing its work. The engineer was not working the engine so it would develop its power.

I recollect it is only a short time ago I was talking with the Superintendent of Motive Power of another road, and he was telling me about the way they were rating their tonnage, and that it was clearly guesswork, and the engine was not pulling as much tonnage as it should. If there had been a test car behind it they would have known positively that the engine was not doing its work. Then, again, I think, to some extent, that our Master Mechanics, when it is being left to them to control the pulling power of the engine, are human, and like to have a little leeway with the engine for occasionally not having it in condition to do a maximum amount of work, and possibly they might shade the power of the engine to some extent, but, with the test car and with the scientific gentlemen who handle that kind of work, all that is knocked on the head, and subsequently, if the engine does not pull her tonnage, we can go to the mechanical department and say: "What is the matter with your engine? She is not doing her best, and ought to pull several hundred tons more." This work is now beginning to show in the tonnage rating, and is the result of men being turned out from the mechanical schools from all over the country.

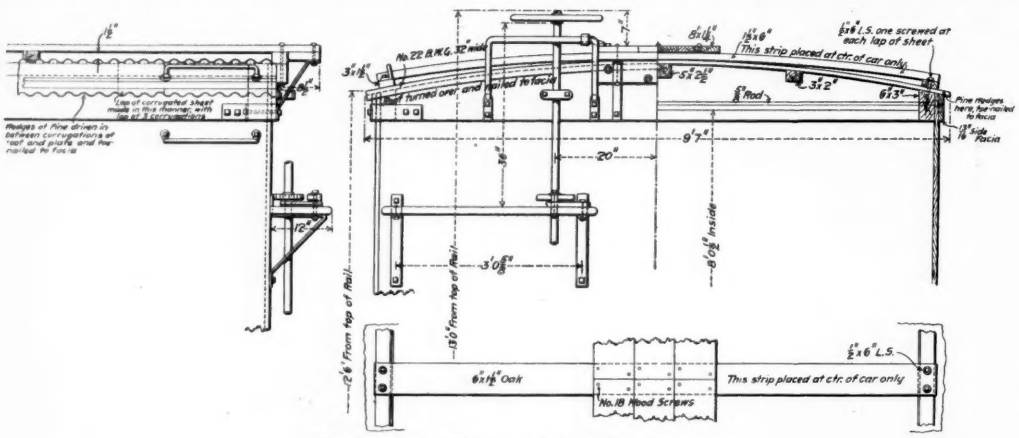
It has been a favorite theme of the Master Mechanics, that it is the tonnage that is killing the engines. We do not believe that at all. What we argue is, that the engines are able to be worked to their maximum and that they are not built to be babied over the road, and

*Extracts from a discussion on "Equated Tonnage Rating," before the Rocky Mountain Railway Club, April, 1903, by Mr. G. W. Rhodes, Assistant General Superintendent of the Burlington & Missouri River.

we are figuring on the rule that there are a great many other things besides tonnage—the neglect of which does the engine much damage. There is much more damage done to the engines when they are washed out in the roundhouse than ever occurs to them from pulling tonnage on the road. What I mean is, that it is not the tonnage that makes the flues leak and makes the stay-bolts leak, etc. It is the neglect they get when they are not in service. We have had so much of that on our own road that we have at the present time a man specially employed to go from point to point all over our 4,000 miles of road, and instruct the men how to take care of fire-boxes and boilers, not only in service, but when out of service. The New York Central is doing the same thing. They found that their failures in locomotives, due to improper care of boilers and fire-boxes, are so great that they have employed a specialist to travel over their road and see that the boilers and fire-boxes get intelligent care and attention when they are out of service. The men in the mechanical department will try to excuse some of their improper care of locomotives through the fact that railroad men are now beginning to try and make engines do their full amount of work.

Mexican Central Box Cars.

The Mexican Central has recently received from the Jeffersonville shops of the American Car & Foundry Co. 150—60,000-lb. box cars, designed to conform to the standards adopted by the American Railway Association and Master Car Builders' Association as regards the interior dimensions and outside clearances. While the general design is according to established practice, the roof and draft gear have some novel features, as illustrated. The roof, as shown by the detail, is of No. 22 gage corrugated galvanized iron sheets, 32 in. wide, rolled to conform to the outlines of the end plates and carlines. They are secured only at the edges by a 1½ x 3-in. strip laid on top of the sheets and held by ½ in. lag screws passing down through the roof strips and sheets into the side plates. At the ends of the car the sheets are turned down over the end fascias and nailed to same. These roof sheets are not fastened to the ridge pole on purlins, and the running boards are secured at the ends and center of cars only, thus leaving the roof without nail holes to cause leaks. This roof has been tested for some years by the Mexican Central and has given excellent satisfaction, there being no snow or sleet to cause trouble, while on the other hand the hot sun has a bad effect on wooden roofs, shrinking and warping the boards.



Roof Details—Mexican Central Box Car.

On smaller cars the lag screws holding the roof sheets can be put into a 2-in. fascia, but on these large cars it was not possible to do this and keep within the proper clearance. The cars are equipped with Westinghouse friction draft gear and malleable-iron draft sills. These sills were designed to take the same bolts which hold the sills of the Dayton twin-spring gear which is also in use on the road, and it is possible to remove one gear and apply the other with no changes in location of bolts. The arrangement presents a strong, neat appearance, with the number of parts reduced to a minimum. The cars have pressed-steel bolsters, and the ends of the draft sills come against the bolsters, as well as having lugs let into gains in the center sills to relieve the bolts of severe stresses.

The illustrations are presented through the courtesy of Mr. Ben Johnson, Superintendent of Motive Power and Machinery.

A New Creosoting Process.

BY HERMANN VON SCHRENK.

The advent of any process for preserving timber at a low cost is always to be regarded with interest in this country. This is particularly so when such a process uses a preservative of acknowledged and undisputed value. The process invented and patented by Mr. Max Rüping, of Charlottenburg, Germany, and recently introduced under the name of the "Rüping process," claims to preserve timber with tar oil (creosote) at a cost about one-fourth of the present cost.

Tar oil, commonly called creosote, is now regarded by everyone as the most valuable and most efficient wood preservative. Its high price and the comparatively large amount necessary to properly preserve timber have been the only obstacles to its general use as a wood preservative. Various processes (notably the zinc creosote process as used in Germany, and the Allardyce process, both using zinc chloride and tar oil), have been brought forward with the idea of cheapening the process using creosote alone.

The Rüping process claims to properly preserve wood with about one-quarter the amount of tar oil ordinarily used. It is based upon the following considerations: Wood is composed of a series of tubes. The walls of these tubes form the "wood fiber" proper, which decays, and which must be penetrated more or less by a preservative to prevent such decay. As now used the creosoting process results in filling the openings as well as the walls of the cells with tar oil. Mr. Rüping claims that an impregnation of the walls is sufficient to ensure complete preservation of the wood. The amount of tar oil now used to fill the cell openings he regards as a waste. By his process he claims that only the walls are impregnated, and that the tar oil which ordinarily fills the cell openings is saved.

Briefly stated the process consists in filling the impregnating cylinder in which thoroughly seasoned timber has been placed, with compressed air at a pressure of five atmospheres. Tar oil is then run in under a pressure of 15 atmospheres. The claim is made that the air pressure in the cell openings prevents the tar oil from filling these openings, but that the porous walls because of the capillary forces operative there readily absorb the tar oil. When the tar oil is run out of the cylinder, any excess oil not necessary to secure complete wall penetration is squeezed out by the compressed air.

Sections of ties treated in Germany by this process, shown to the writer, were completely penetrated and a pole section showed penetration up to the heart wood. While it is as yet too early to form any decisive opinion of the new process, it deserves consideration and study. Tests will be made to determine the truth of the inventor's claim as to wall penetration, and to determine the possibility of making so large a saving in tar oil and at the same time giving a 12-15 lb. penetration.

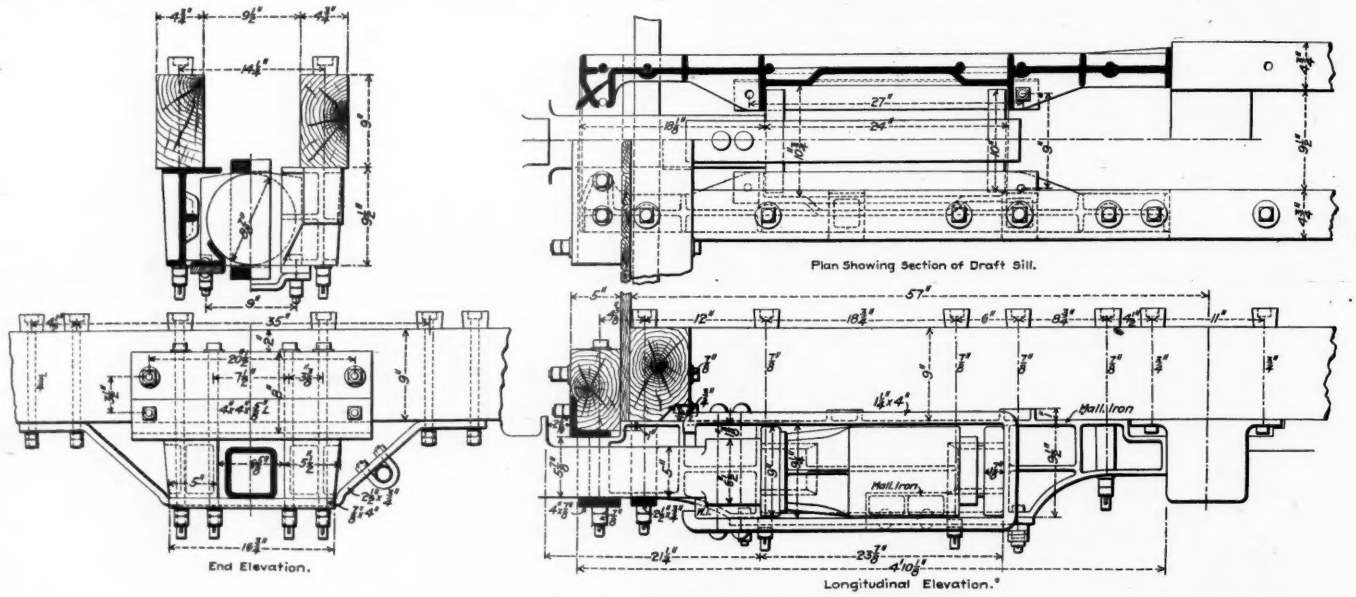
Train Movements at Boston South Station.

The summer time-table of the Boston Terminal Company shows a considerably increased number of trains over any previous table, and the total number of movements each week day is 1,585. This station has never yet been used to its full capacity; and, therefore, while it is the largest station in the country, no train-movement records have ever been made, except for very short periods, to equal in magnitude those of other and smaller stations. Now, however, the extensive facilities of the station are being put to more constant use. The totals of the different divisions are tabulated as below:

	Week-day trains.	Sunday trains.
Boston & Albany	214	68
New York, New Haven & Hartford—		
Providence Division	309	99
Plymouth Division	231	69
Midland Division	75	12
	615	180
Total regular trains	829	248
Drafts to and from storage yards	389	92
Light engines to and from engine houses	367	177
Total movements to and from terminal	1,585	517

Dutch Railroad Strike Legislation.

It may be remembered that in January last a strike on the railroads of the Netherlands was successful and so greatly alarmed the public that legislation was introduced into Parliament to prevent the arrest of railroad traffic in future; and that in April last the agents of the associated employees declared that a total suspension of train service would follow unless this proposed legislation was withdrawn. As this was not done, a strike followed, but soon ended; while the legislation was carried through. This was included in three different bills. The first provided for the establishment of a military railroad brigade, which in case of emergency is to conduct the train service, or the most indispensable parts of it; the second provided for a parliamentary commission to investigate and report upon the demands and complaints of the employees. To neither of these bills was there any opposition. The third bill amended the criminal law so that any man hindering another at his work should be liable to three months' imprisonment or $40 fine; several persons joining for such a purpose should be liable to double this penalty; a railroad employee or one temporarily engaged in railroad service refusing to do his work, and so causing an interruption in traffic, should be liable to six months imprisonment or $120 fine; a number of employees combining for this purpose would be liable to four years imprisonment; if by such a movement traffic should actually be interrupted, penalties of from 18 months for individual action up to six years



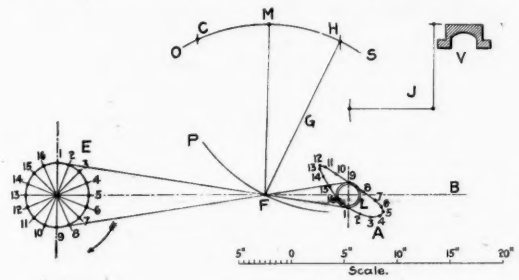
Draft Gear Details—Mexican Central Box Car.

for action in combination might be inflicted. Any one in future ordering railroad employees to strike might be imprisoned for five years. It was this bill imposing penalties whose withdrawal was demanded and on account of which a strike was ordered. It had been reported by a committee which had had the subject long under consideration and came before a special session of the Parliament early in April and was receiving general favor in the discussion, with some amendments mitigating the punishment, when the strike was threatened, which was to include all men employed in transportation; and, when it was found that the railroad men would not all obey the strike order, a general strike of all trades was ordered. The threat was followed by the continued discussion of the bill and its adoption, article by article, by an immense majority in the lower house and unanimously by the upper house, and it became a law by the signature of the Queen.

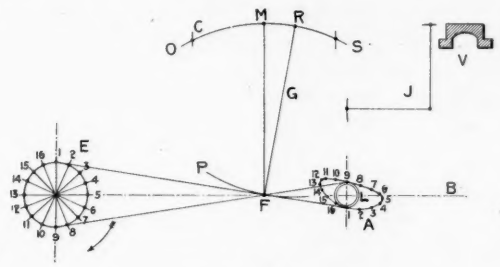
The Dutch railroads, though chiefly owned by the state, are not worked by it but by two operating companies, to which they are leased. The force of employees, however, is organized much like that of a State system, the more responsible positions being held by men holding permanent appointments, with rights to promotion, pensions, etc.

The Marshall Valve Gear for Locomotives.

When both eccentrics of the Stephenson valve gear have the same angular advance there is a great increase of lead from full-gear to half-gear if the eccentric rods are less than 4½ ft. long. Many locomotives have their valves set "blind" in full gear to avoid excessive lead at shorter cut-off. On English roads many locomotives are fitted with the Joy valve gear with constant lead. In Belgium, France and Germany the Walschaert valve gear is much used, which also gives a constant lead.



Long Cut-off.



Short Cut-off.

Marshall Valve Gear Diagrams for Locomotives.

The accompanying motion diagrams of the Marshall valve gear, worked out by Mr. Harry Cornell, ex Junior Engineer Ss. "St. Louis," give a clear idea of its action. When the engine stands on the forward center the eccentric is at 1 on the eccentric circle E, and when on the back center the eccentric is at 9. The fulcrum point F on the eccentric rod is guided through the arc P by the link G, which at long cut-off radiates from H on the arc O S, while on the short cut-off diagram the link G radiates from R on the arc O S. The point at which the eccentric rod is connected by link and pins to the valve operating bell crank J passes through the path A while the engine makes one revolution in the direction indicated by the arrow. The lap and lead circles are at L. To reverse the engine the guiding link G must radiate from some point on the arc O S between C and M. It will be seen that the path A passes higher above the central line of motion B than below, causing the valve V to travel further in one direction than the other and thereby compensating for the disturbing effect on the cut-offs caused by the angularity of the connecting rod. The fulcrum point F on the eccentric rod will always come to the same point when the eccentric is at 1 or at 9, giving a fixed lead for all cut-offs.

The Marshall gear as applied to a 4-4-0 locomotive has but 12 working or rubbing parts as against 20 for the Stephenson link motion.

Railroading in Australia.*

"The conditions (in New Zealand) are so very different from what they are in our country that one has to actually visit it to comprehend the vast difference between railroading on the scale that they do it, and the scale that we do here. Nearly all the colonial railroads are odd gages, the majority of them being 3 ft. 6 in. In the five states of Australia there are seven gages of railroad. Such a thing as through traffic is unknown. You have to get out of your sleeping car whenever you get to the boundary, no matter what time of night it is, and get into another one. Most of the schedules on the through express trains are arranged so as to arrive at junctions at a reasonable hour. For instance, on an express train from Brisbane to Adelaide in South Australia, you would come to the New South Wales border. There we change from a 3 ft. 6 in. to a 4 ft. 8½ in. You go on this to Albury in Victoria, where you change from a 4 ft. 8½ to a 5 ft., and then leaving Melbourne for your trip in South Australia, you change back to a 3 ft. 6 in.

*Extracts from paper read before the Richmond Railroad Club, April 10, by T. W. Gentry.

"All of the Colonial railroads are in charge of English or Scotch engineers. As a rule they are mostly old men who came out a great many years ago, and have never returned home. There are few English mechanical magazines published; the only one I met with was one of those magazines that contains such matters as only protessional and technical men become interested in. There is no publication to interest the shop man or the apprentice boy, and I think that has a great deal to do with the fact that these men are in the old rut that they started in years ago.

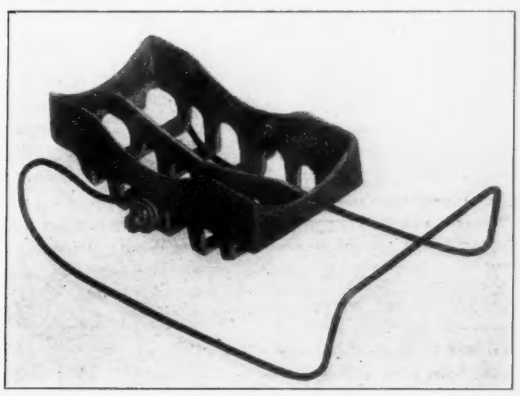
"If you could eliminate the matter of prejudice against our work we could advance with them very much faster. They don't seem to be very jealous of our agricultural machines, hats and caps, boots and shoes, pianos, tinware or any of our steel and iron manufactures, but when it comes down to the American locomotive the average English and Scotch engineer is certainly very much opposed to them. You won't find one man in ten who will agree with you that the American built locomotive will compare with the English and Scotch built engine, and they will produce the data to prove it to you. Of course they can prove it to a man who doesn't build locomotives. Now you take one of our locomotives where we have as much heating surface again as they have, an engine capable of hauling three times the load their engine will, and they will put on an ordinary driver and stoker, as they term them, and as a consequence they will fire the American locomotives just as they did the English engines with half the heating surface, half the grate surface, have her popping off at every point on the road, both injectors working, and then they will tell you they can show you an economy of from 10 to 15 per cent. in favor of English engines. However, they don't haul the same load under the same conditions; one of our engines will haul about 25 of their trucks up the maximum grade, while their engine will haul about ten. Of course the train is shorter, the friction is less, and the other conditions enable them to make better mileage. The main trouble with the American product is that the average Englishman cannot comprehend how we can build them as fast as we do. At the best works in England, which are probably Neilson & Reid, at Glasgow; Dübs & Co., and Sharp Stewart, either one of which is better equipped than any single works of the American Locomotive Company in America, they turn out about four locomotives a week. Our works at Richmond have turned out seven for the last few weeks. And when you tell a man there that the Baldwin Locomotive Works can turn out six in 24 hours, they simply think you are a liar, and that is all there is to it. These people tell you that if it is possible to assemble the parts and accurately fit them together, and turn out locomotives at the rate of six per day, that you have got to absolutely neglect some important part about them to do it. The consequence is that when you talk locomotives to them they will tell you that one British locomotive will last three times as long as the best American. I made a trip from Albury, in New South Wales, to Melbourne on the Melbourne express, and while they were transferring the baggage and the custom officers were working I strolled down to see what was going to haul us. This was a 5 ft. gage road. I saw the engine, which was an inside cylinder engine, crank axles, with driving wheels about 8 ft. high; she was what we would term an eight-wheel type. That engine was built by Hawthorn, at Leeds, in 1862; in other words, she was about 40 years old. She looked as pretty as a new pin; had a real Russian jacket, brass bands, brass cylinder casings and covers, and such old platings and fittings as we had on engines probably 25 or 30 years ago. The following day I went out to the works in Melbourne where these engines were housed, and I had an opportunity of looking over this old engine. I inquired of her history, and found they had more than 20 as old as she was still in service. The newest engine I found was about 12 years old. These were freight engines built in Australia, but more than two-thirds of their entire engine equipment was more than 20 years old, a few were more than 30 years old, and quite a large proportion of the passenger equipment was nearly 40 years old. They still had the badges with names on the smoke boxes where these engines had been built; large brass plates telling that the engines were built in 1862. I procured from their general manager their last year's annual report, which shows that their goods engines averaged not over 25,000 miles per year, and express engines about 10,000 miles more. In other words, it took the engines there about 30 years to make the same mileage that one of our average engines makes in 10 years. As I said to their Superintendent of Engines, 'your engines last 30 to 35 years; our engines do the same service in from eight to ten years. We are not in the market for posterity. We are making them for present use.'

"In the government railroads most of the shops go to work at 9 o'clock in the morning; they have an hour for lunch and quit at 5 in the evening, with half holiday every Wednesday and Saturday. They are all under government control. There are no restrictions whatever for smoking—men and boys are allowed to smoke at random all over the place. I will never forget my first visit to the works at New South Wales. A cigar there costs you a shilling. Just before I got to the shops I lighted a cigar, but when I got in the gate I did not think I would go in there smoking, as I did not know anything about their rules, so I threw about half of it away; this was about 8.30. There was no one there, so I asked an old caretaker what was the matter; had the shops broken down? He told me no; they did not get to work until 9 o'clock. At 9 o'clock I saw every fellow, instead of knocking out his pipe when putting on his overalls, would start up his machine still smoking. When I asked one of them if he smoked during working hours he told me they smoked all the time; said everybody smoked on account of the malaria. The manager told me that had been a custom for a great many years; said the men were hard to get and hard to keep, and he had to let them do most anything, and he got just as much work out of them anyhow. The next time I went out there smoking I did not throw my cigar away."

The Commonwealth Waste Holder.

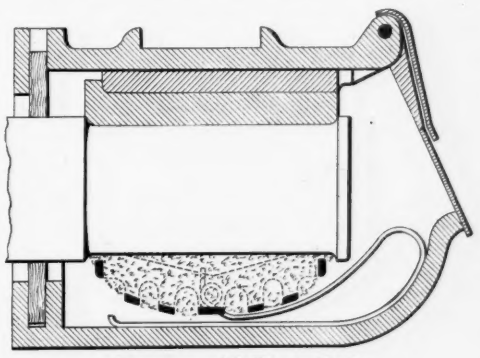
A special form of waste holder, designed to give thorough journal lubrication with a minimum of oil and waste, is shown in the accompanying illustrations. The waste receptacle is made of malleable iron, and the ends are shaped to conform to the curvature of the journal, against which they are pressed by the spring-steel wire support. This contact of holder and journal is to relieve the waste from too great pressure, and consequent packing and exclusion of the oil.

Not more than 5 oz. of waste is required for a holder, or 2½ lbs. for an eight-wheel car. The depth of the holder is such as to bring the waste close to the bottom of the journal box, requiring a depth of oil of about 1 in. in the latter to keep the waste saturated. It is claimed that only two pints of oil per journal is required for the initial charge, and thereafter one pint per journal per 20,000 miles is all that is needed.



Commonwealth Waste Holder.

These holders can be applied to any car, tender, or engine truck journal box without any change in the latter. A special form is also made for driving wheel boxes. The receptacle and its wire support can be handled as one piece and are quickly inserted or withdrawn. It is easily possible to determine the amount of oil in a journal box at any time. Some of these holders have been in service on the Southern for a year or more with very satisfactory results. They are called the Commonwealth waste holder, and are made and sold by the Commonwealth Railway Supply Co., Monadnock Building, Chicago.



Commonwealth Waste Holder.

The Jura-Simplon Company's railroads went into the hands of the Swiss government May 1. This is the fourth of the great companies whose lines have been acquired, and there remains only the Gotthard Railroad, which by its charter cannot be taken for a few years yet.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

During the past eleven months on the Union Pacific road a great reform in shop management has been developed. It has commonly been referred to as a strike. It has really been a successful reform fully carried out in spite of the opposition of labor unions. The essential feature of this reform has usually been called piece work; whereas it is a daily wage and premium system. The results have been extraordinarily good both for the company and for the men. The men earn more, in many cases an increase of one-third, while the company gets better work at less cost. For example: One man now tends two machines which make an inside and an outside cut of two piston rings at one movement, as compared with the previous union rule of one man, one machine, one cut. The man does four times as much work as he used to do, and the company gives him a fair proportion of the money saved. The wood-work of the locomotive pilots cost, under union rule, about $7, but they now cost $3, and the men making them earn $4, instead of $3 a day. These are fairly illustrative examples of the money results to the employer and to the men at work in the shops of the Union Pacific. But there are other results of this temporary escape from union tyranny which promised to be of even greater value to all concerned, in future years. Undesirable men and agitators were weeded out, and a high grade of industrious, studious, ambitious men from all over the country were attracted to these shops of freedom. The officers believe that rarely indeed in the history of railroading has such a promising body of men been gathered together, and that if the system continues the results are inevitable; that future officers of the road will be chosen from among them.

But the Union Pacific is part of a "system" with vulnerable branches whose life can be sapped by sympathetic strikes. The trade union's demand is that the Union Pacific shops be restored to their former bad conditions, under threat of paralyzing the entire Southern Pacific system. On May 15, Mr. Harriman sent to the "Grand President and Organizer of the Brotherhood of Boiler Makers," the telegram given below; but before reading it:

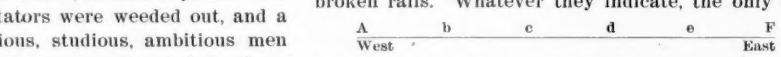
> "For pity's sake, you that have tears to shed,
> Sigh a soft requiem, and let fall a bead."
> [Telegram.]

"I will recommend to Mr. Burt, President of the Union Pacific, and suggest to you for consideration the following:

"The sympathetic boilermakers' strike on Southern Pacific and other lines to be called off; Union Pacific strike to be called off; matter of piece work to be left to the men themselves, both those already employed and to be employed hereafter by the Union Pacific and piece work not to be further extended on the Union Pacific and to be abandoned at the end of four months, if so determined upon by a representative of the company and of the men; if they cannot agree, it to be referred to other representatives not directly engaged in managing the road or the strike; the piece work system not to be extended to the Southern Pacific or other lines, except after conference and agreement with the boilermakers; no discrimination to be made against former employees on the Union Pacific when places are to be filled and no discrimination to be made on account of their accepting temporarily the piece work or not, and any adjustment thereof to be determined between representatives as above provided. In lieu of this, call off the strike, both sympathetic and otherwise, as above, and refer the whole Union Pacific controversy in its present condition to arbitration to be agreed upon."

The Signal Engineers, at their meeting in Chicago last week, talked much of other subjects than those prescribed for them in the programme of the meeting; and they discussed operating rather more than engineering questions; but this was quite pardonable, and, on the whole, commendable. It is better to be irregular, and say something worth while than to visit Chicago and learn nothing. Mr. Sperry's question, "Do you consider the block-signal capacity of your line when making out time-tables?" did not appear to be susceptible of serious discussion since the obvious answer is "No," and for the reason that the question is rarely a practical one. It arises only where passenger trains are very frequent; and on most lines where that condition exists the block sections are already very short, so that the signal engineer has no further duty in the premises. If the superintendent, in scheduling 10 trains in 30 minutes, chooses to give the first five trains 20 minutes and thus to leave only 10 minutes for the other five trains, causing constant small delays, he needs something other than discussion, for the remedy is obvious. On most or all of the lines mentioned at the Chicago meeting the block-signal capacity of the road is tested, not by scheduled passenger trains but by unscheduled freights; and the adjustment of the train movements to the blocks is effected automatically. The yardmaster learns by experience that he cannot start trains any faster than the block signals will let them get out of his way. The experiment on the Pennsylvania lines, described at the meeting, of a short section of automatics sandwiched in between non-automatic block sections on a single track line deserves particular notice. While diverse methods or styles of signals are, on principle, undesirable, there can be no fundamental objection to this Pennsylvania practice, if the rules for both kinds of signals are made uniform with the rules for the same kind of signals (and the same practice) on other parts of the road. Even the man who stickles for extreme uniformity—who will not have five miles of automatic signals unless he can have 50 miles—must admit the force of Mr. Foster's remark, that often the appropriation for the five miles can be got when the larger one cannot. It is a case where money not only "talks," but has a right to talk—and to decide.

The conflict between the men who signal between A and F and the machines which signal from b to c, c to d, and so on is more apparent than real. When A permits a train to move eastward he does not give it authority to go to F, even though he may know that the road is clear of trains to F; he gives it the right only to b, for the engineer must obey the automatic signals at b, c, d and e. They may indicate broken rails. Whatever they indicate, the only reasonable rule is to have their indications treated with the same respect at all times. To be complete, there should be an automatic signal at A as well as at b, c, d and e, so that fast trains could be given an absolute signal from A to b; though if the blocks west of A and east of F are long, there will be little need of this. Completeness would also necessitate automatic signals for movements up the hill as well as down. There is no inherent wrong or defect in superimposing one block system upon another, provided neither one depends on the other to the extent of neglecting its own duty, and provided the rules are enforced. If A, dealing only with F, gives a clear signal to a fast eastward train when the line is not clear to F, one of the automatic signals will prevent his error from causing a collision. If A wrongfully authorizes F to send a train westward his error is not made any worse by the presence of the automatic signals. Even with a road (single track) completely equipped with automatic block signals for movements in both directions, there must be some person, either in a station office or at headquarters, to decide which of two equally important opposing trains shall have preference; and the operators at A and F in this case have about the same status as a person in that position. In dealing with the problem of using a single track to its fullest capacity, situations will always be found where it is desirable to have very short block sections for trains following one another, but where it is not practicable to provide meeting points at equally short intervals. To "bunch" the eastward trains in one part of the day and the westbound in another part is sometimes the only way to relieve a bad blockade; and if we are to bunch trains, we need short block sections.



The Principles Involved in Dealing with Brotherhoods.

To those who watch closely the negotiations, ultimatums and strikes, or settlements of labor troubles recently on railroads, the indication is that there are beginnings of a solution which may develop and be lasting; that the way out will be by adherence to principle rather than by smart dickering. Those railroad officers who have adhered, with good judgment and reasonable diplomacy, to the basis principles involved in the relations between "labor and capital," have fared best; those who have, with perhaps equal fidelity to their trust, but with less respect for righteousness, yielded grudgingly to the brotherhoods whatever seems necessary to avoid a strike have fared worse. Incidentally, it is well to remind ourselves that the present situation, although serious, is not comparable to labor crises through which we have passed successfully. In the year 1877 several large cities were in the hands of mobs and the militia were under arms in half a dozen States, including New York and Pennsylvania. The city of Pittsburg was set on fire and railroad shops and depots were burned. The government of Fort Wayne was temporarily overthrown, and its place taken by a committee of strikers, who proclaimed themselves the friends of law and order. A similar condition of affairs existed in Hornellsville and other places in western New York. It came up later in the Martin Irons strike on the Missouri Pacific Railway, and again in the strikes following the Debs strike against the Puliman Car Company.

No great problem is well solved, and no relations based on the solution are lasting, where the basis principles are not fully developed or where they are disregarded. It is well to remember not only that every man has a right to life, liberty and the pursuit of happiness, but also the corollary that no man may interfere with another's rights to these high privileges. If this experiment of a republican form of government which we are making means anything, it is that every citizen must have a chance to rise by his own industry, integrity and merit from a low place to a high place as freely as do the bubbles in a boiler. In some of their requirements the brotherhoods violate this principle in restricting the usefulness of their members to something like the average ability of all of them; in taking away from non-union men the unquestionable rights to life, liberty and work; in demanding of a railroad officer such an uneconomical management as will compel the employment of wasteful labor.

It is inevitable, if there is a God and a government, that these wicked violations of principle will not prevail, and that those who abet them are doing wrong; but it is much easier for us to preach this evident truth than it is for the responsible railroad officer to involve his company in a present loss in defense of right principles. He needs not only high moral courage and a broad view far ahead; he needs still more the support of his directors and stockholders. The sum of it is that progress in this direction must come as fast or as slowly as directors and officers learn that firm and intelligent adherence to principle is profitable. No one ever heard a Burlington or a Reading officer express regret for the results of their expensive struggles with the brotherhoods for the right to run their own roads. The moral could be pointed even more forcibly if it were permitted to publish the details as well as the results of several railroad-with-brotherhood negotiations of the present year. But a small part of it has appeared in the newspapers, and no public reference has been made to settlements on some roads where no unworthy compromise was allowed; where the principles here stated were strictly observed. We believe it is true that progress is being made.

There is another basis fact. Coldly and unfeelingly stated, it is that labor in its relation to civilization, is nothing other than a horse-power unit, or a kilowatt hour. Labor-saving machinery is designed to make the labor units more productive of result. A steam shovel, with a small crew, saves the room and cost of a lot of laborers on the bank. Big locomotives and cars need fewer trainmen for the work done. All that the laborer does is to supply brute force, so much horse-power. The trainmen and shop men use less force and more skill, but they conform to the plan laid down by the guiding brain. Within a narrow range and to a limited degree does the laborer determine why, how, when and where. That we build office buildings instead of pyramids, plow

with the steam driven steel share instead of the Egyptian stick, propel the ocean liner instead of the trireme and go to war with ordnance instead of the long bow is not because of any achievement of labor at the daily task. It is the brains that invent and design and discover processes, appliances and methods, and the men of grasp and daring that utilize these discoveries and inventions, who show labor how and when and where to do, multiplying the avenues through which it obtains employment. Thus the products used by the laborer and his family have increased in number and volume and decreased in price, his life has been made more varied and placed on a higher plane. It is thus that the laborer has received the greatest benefit, and not from the trade union which opposes every appliance and every method that interferes with the old and accustomed routine.

Freight Delays at Stations and on the Road.

"We doubt if at any previous time there has been greater interest in the subject of demurrage than exists to-day. Within the last few years there has been a growing disposition on the part of the railroads to apply their regulations more rigidly and to use strong measures to enforce them, and, on the other hand, by their customers to resist what seem to them unreasonable charges and methods. It has been the purpose of the railroads as far as possible to make a demurrage charge a lien on the contents of the car by legislative enactment or by action of State railroad commissions. This has been resisted by lumbermen, usually with success, though recently in Texas the State railroad commission assented to considering the demurrage charge a lien. Without some such action the courts have, we are informed, uniformly ruled against the railroads' claim. They have not disputed the justice of a demurrage charge on general principles but have denied that it could be a lien upon the contents, have denied the right of the railroad to withhold delivery pending payment of present or past charges, and have said that the recourse of the railroads in case of refusal to pay such charges was in courts. . . . Reciprocity is what lumbermen want. A bill has been introduced into the Virginia State legislature, legalizing a demurrage charge and at the same time requiring prompt service on the part of the railroads. There should be prepared a bill which should in these particulars govern interstate traffic, provided that it shall be determined by competent legal authority that such a measure is practicable."

The foregoing is from the *American Lumberman*. The essence of its demand is that when a carload of bulk freight is four days too long on the road the carrier shall make a discount of, say, two dollars. Only by thus punishing itself for its own faults, say the lumbermen, can the railroad justify its punishment of consignees for the delays which they cause. This proposition has been so often made, and has so regularly proved to be nothing but idle talk, that it is perhaps an imposition on the reader to again give space to it; but if, as our contemporary says, the lumbermen's grievances are growing more acute year by year, it may be worth while to say a word.

No one disputes the equity of a penalty for slow movement of trains. The Pennsylvania recognized it last year by announcing a rebate to passengers who lost time on its 20-hour train between New York and Chicago. In the movement of live stock and perishable goods the railroads understand, in hundreds of cases, that failure to make delivery in satisfactory time means a severe penalty—the loss of the traffic to some competitor. But no one has ever devised a workable scheme of penalties for delays of ordinary or slow freight because, in this traffic, precise schedules are out of the question. The fact that lumber or grain or coal reaches destination with a good degree of regularity deceives the observer into the belief that such regularity can be planned for and determined beforehand; but a little examination would reveal that this cannot be done except for a movement strictly limited in volume. Take the movement between New York and Buffalo, for example. The high class merchandise, or the refrigerator cars, or the live stock can be run on a reasonably regular schedule, in good weather, because the whole of these classes would require but a small part of the engines and men and facilities available; in case of delay or failure there are the facilities provided for the slow traffic to draw upon as from a reserve. Taking all the freight traffic together, the facilities are so nearly used up to their total capacity that there is no appreciable margin for errors, and therefore a liability to penalty would at once necessitate an increase in prices. The present rates for transportation are based on a service which does not provide for unforeseen delays.

A parallel may be found in the telegraph service. A message can be sent from Chicago to New York and delivered inside of ten minutes; but, in providing for the whole volume of telegrams, the company cannot guarantee delivery inside of 30 or 60 minutes, or such longer time as may be necessitated by the volume of business and the relative number of wires. Unless the number of wires and operators were largely increased, messages must sometimes wait for others filed earlier. Our parallel is inadequate, because a surplus of engines and yard facilities costs an immeasurably larger percentage of increase than do telegraph wires and additional operators.

Normally, a freight car should be unloaded when it reaches destination. The railroad should hurry the unloading by a penalty, even if the punishment were to fall on itself, for a car is a costly store-house. When cars are over-plenty this does not relieve the railroad superintendent from the duty of maintaining correct practice. A railroad is bound to charge consignees for the space on its grounds occupied by undelivered freight, whether the goods be contained in a car or in a brick building. To give storage free, even for three days, is unfair. That free storage has long been the almost universal custom does not make the practice either right or economical.

These axiomatic principles are not always easy to apply, of course; and for that reason the railroads do not attempt to make a rigid application of them. The most significant and perhaps the most creditable thing about the best managed demurrage bureaus is that they refund a large percentage of the sums that they collect. It is impossible to apply exact time-rules to every delivery of bulk freight, but the fact that exact justice is impossible is no reason for failing to reach something like an approximation to it. We cannot have an inflexible rule, but a flexible rule is useful and necessary. In allowing for the other elements which make refunds necessary, the wise demurrage agent takes duly into consideration those delays in transit for which the lumbermen want a statutory penalty. Statutes are hard to enforce unless they are precise; and as this one could not be precise we suggest to the lumbermen that they turn their efforts in another direction and cultivate the acquaintance of the demurrage collector. If he is one of the best of that class he will do them full justice; if he is not one of the best, we can point out a number from whom he can take profitable lessons.

At the Railroad Telegraph Superintendents' Convention at New Orleans, May 13, which was reported in the *Railroad Gazette* last week, the use of typewriters for copying train orders was looked upon with favor. If the sense of the meeting was correctly interpreted, there was much sentiment in favor of the typewriter and none against it. One maker has devised a machine called "The Train Order Special" in which the numerals are larger than in most typewriters. From sample train-orders furnished by the typewriter company, the recommended practice appears to be to write train orders wholly in capital letters. In the samples, the sixth carbon—that is to say, the seventh sheet—is entirely legible; but in view of the fact that, at best, a figure or letter in a fifth or sixth carbon may often be slightly defective, and that often more than seven copies are needed, one naturally questions whether the time in an order should not be written in words and not repeated in figures. As long as the figures are there, it is difficult to believe that trainmen will not, when in a hurry, depend on them and neglect to carefully read the words. This criticism applies, of course, to pen writing also. If the typewriter is to be used there will be an advantage in putting double space between each two adjacent figures; though constant care would be necessary to enforce an order to this effect.

But whatever may have been the sentiment about the typewriter at New Orleans, it is a fact that certain careful railroad officers are not yet convinced that the use of the machines for train orders is justifiable. One big road, which has tried them in this work, has decided not to use them. The feeling seems to be that mistakes in writing are more likely to occur on the typewriter than when the operator uses the pen or pencil; and mistakes are, of course, unpardonable; that is to say, the requirement is that always in such a case the operator shall destroy his message and begin at the beginning and write a new one. Quite likely it is true that such mistakes would occur frequently during the first few months. Whether or not they would continue after a suitable instruction period is not so easy to determine. This same question came up in a discussion before the Iowa Railroad Club last month, and Mr. H. A. Dalby said that he had been unable thus far to convince himself that the typewriter was suitable for train orders. Mr. Dalby is one of the most prominent despatchers in the country and has shown good judgment in expressions of opinion. His only suggestion for more surely providing against errors in train orders was to maintain strict discipline; a tacit admission that discipline usually is not strict—which everybody knows, whether the fact is or is not admitted in public discussion. In short, the rules for perfect train despatching to-day are the same that they were a dozen years ago, when Mr. Anderson made them clear in "The Train Wire." It is a maxim in morals that the worst man knows the law better than the best man obeys it. This will almost apply in train despatching. One of Mr. Dalby's reasons for wanting numbers spelled out was that operators frequently do not send plainly (in repeating orders). But why not compel them to send plainly? Would the sending then be so slow that it would be quicker to send the orders by a messenger boy? The enlightened reader of the *Railroad Gazette* will understand, of course, that all of the foregoing is for the benefit of the unregenerate; those who do not use the block system. The block system does away with most of our train-order troubles.

To get support for a merchants' freight bureau in any city, it is customary to start with a fact, or a claim, or a theory, that there is another city somewhere, from which something can be taken. To go to the railroad with the claim that its charges are too high, absolutely, seems to be an undertaking that merchants do not wish to tackle; but if the argument can be started with a showing that some other city (and, incidentally, some other railroad) is enjoying a profitable traffic that ought to be given up, there is hope of getting the railroads to do something, and the merchants will put their futile shoulders to the wheel. Members of the New York Produce Exchange started to establish a bureau some time ago, but the scheme has not made progress, possibly because there is no city in sight which is likely to surrender anything to New York. The committees of the Exchange who had the project in hand have been thinking of establishing a bureau with a "high-priced" ex-railroad man as commissioner, but they have concluded that they do not want railroad knowledge, after all, and they now propose that the business be put into the hands of a committee of five members of the Exchange, two of whom must be members of the Board of Managers. This committee is to employ a secretary, whether "high-priced" or not is not stated; but the most suggestive feature of the recommendations is the statement that members of the Exchange who do business through the "outports" will be disqualified for membership on the new transportation committee. In other words, a merchant, to deal with the railroads, must be somewhat narrow; trade interests at Baltimore, Newport News, New Orleans or Galveston are likely to make him too broad minded; the other cities may receive too large a share of the available stock of justice.

TRADE CATALOGUES.

Exhaust Fans is the title of illustrated sectional catalogue No. 149 of the American Blower Co., Detroit, Mich. Illustrations and descriptions are given of the various types of "ABC" exhaust fans intended for the removal and conveying of shavings and dust, elevating and distributing cotton and wool, removal of smoke and fumes, and for use in connection with special heating and drying plants. "ABC" countershafts, blast gates and dust separators are also included; also tables of sizes of pipes for planing mill machinery; speed, capacity and horse-power required for the different types of fans; and other tables of value in this connection. The "ABC" mechanical draft system, hot-blast apparatus and waste heat dryers are also shown. "ABC" electric fans are made the subject of a separate circular.

Two folders of the *Endura Company*, Detroit, Mich., relate to Endura coating, which is for use upon metal work in general. For marine purposes, it may be used on the bottoms of boats of every description, both wood and metal. It is used by the United States Life Saving Service. Statements from some important railroad and other companies testify to its satisfactory service. It is supplied in three colors—black, dark brown and dark olive green.

F. E. Hook, Hudson, Mich., has issued a pamphlet describing the pneumatic coating machines made by him in all sizes from a small hand-pump machine to power machines operated by gasoline engines. The various uses to which such paint saving machines are applicable are described, and a list of important users given.

The Illinois Central has issued a pamphlet illustrating in colors the exterior and interior of each car in the "Daylight Special," running between Chicago and St. Louis. The train is made up of a buffet library, a parlor car, diner, reclining chair car and day coach. A. H. Hanson, General Passenger Agent, may be addressed.

The American Car Seat Co., Brooklyn, N. Y., maker of the "Pushover" seat, has issued a catalogue illustrating the different styles it has on the market, and showing also the details of upholstering of the seats and fixtures. Eight kinds of transverse seats, with "Pushover" backs, are shown.

Short Jaunts for Busy People describes the various attractive lake resorts in northern Illinois and Wisconsin reached by the Chicago & North Western. A large map of the region and information regarding hotels, trains, rates, etc., are also contained in the pamphlet.

The Allis-Chalmers Co. has compiled a list of users of the Reynolds Corliss engines, made by them, showing that these engines are in use in 933 cities and towns in 49 States and territories in this country, and in 70 cities and towns in 20 foreign countries.

The New Technical Dictionary (English-German-French).

In the beginning of 1901 the Society of German Engineers (Verein Deutscher Ingenieure) began the compilation of an universal technical dictionary in the three languages, English, German, and French, which was at the time described in the *Railroad Gazette*. This undertaking has met with general approval and has received assistance from all quarters at home and abroad. Societies and individuals have responded generously to the invitation to collaborate and have proved their interest by the transmission of collections of technical words made by them or by promising such in the near future.

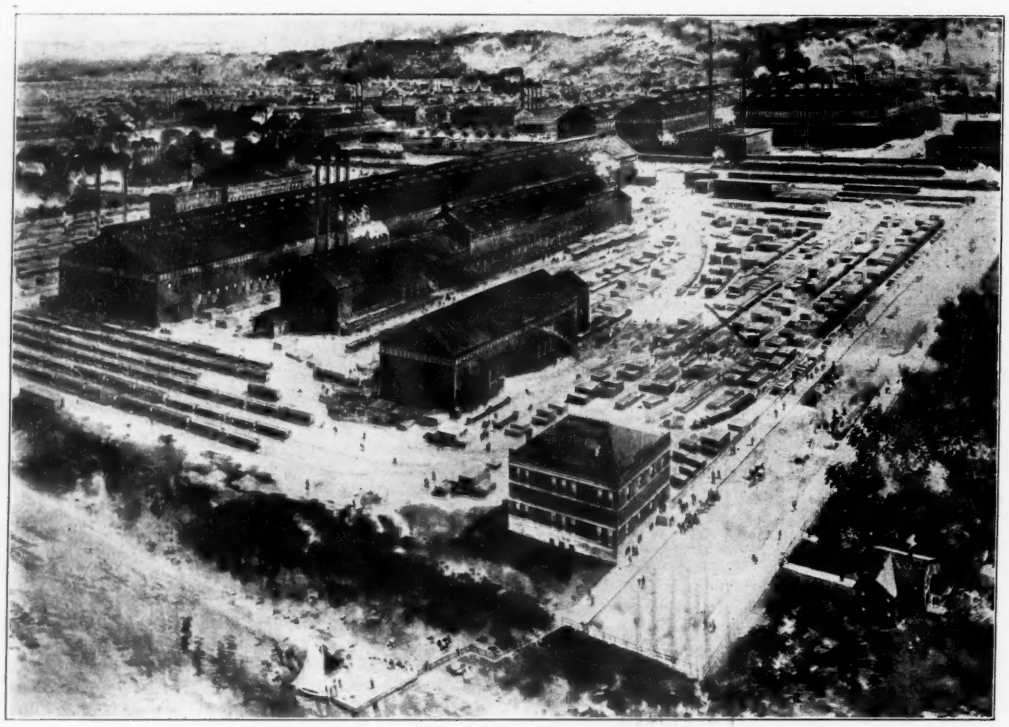
Up to now (May, 1903) there are 341 societies (42 in English, 272 in German, and 27 in French speaking countries) co-operating in the work, either by the systematic collection of technical expressions of the specialties represented by them or by placing technical publications in more than one language at the disposal of the editor, as catalogues of firms, inventories, price-lists, handbooks, etc. Through these societies the Technolexicon has found helpers in Great Britain, Germany, France, the United

States, Austria, South Africa, India, Australia, Belgium, Canada, etc.

Among the English societies are the Institution of Mechanical Engineers, London; the Institution of Electrical Engineers, London; the Junior Institution of Engineers, London; the Society of Chemical Industry, London; the Institution of Mining Engineers, Newcastle on Tyne; the Iron and Steel Institute, London; the Society of Architects, London; the British Optical Association, London; the Optical Society, London; the Cycle Engineers' Institute, Birmingham; the South African Association for the Advancement of Science, Cape Town and Johannesburg, etc.

Of American societies may be mentioned the American Society of Civil Engineers, New York; the American Society of Mechanical Engineers, New York; American Railway Engineering and Maintenance-of-Way Association, Chicago; the American Chemical Society, Brooklyn; the Western Society of Engineers, Chicago, etc. In Germany there is first of all the large majority of the local sections of the Society of German Engineers; then there are the Verein Deutscher Eisenbahnverwaltungen, the Verein Deutscher Chemiker, the Zentralverband der Preussischen Dampfkesselüberwachungsvereine, the Verband Deutscher Patentanwälte, the Deutsche Schiffbautechnische Gesellschaft, and many others. In France, Société des Ingénieurs Civils de France, Paris; Association Amicale des Anciens Elèves de l'Ecole Centrale, Paris; Société Internationale des Electriciens, Paris; Société d'Encouragement pour l'Industrie Nationale, Paris; Société Francaise de Photographie, Paris; Syndicat Général de l'Industrie des Cuirs et Peaux de la France, Paris; etc., etc.

The editor-in-chief will be pleased to give any information wanted. Address: Technolexicon, Dr. Hubert Jansen, Berlin (N. W. 7), Dorotheenstr. 49.



Pittsburgh Spring & Steel Co.'s Plant, at Pittsburg, Pa.

Pittsburgh Spring & Steel Co.'s Plant.

This company was organized in the fall of 1902, purchased the old McCandless avenue plant of the Pressed Steel Car Company, and took possession of it about the first of the year; since that time they have pushed the work of completing the plant with vim and energy. It is unusual that machinery could be procured and a plant put in shape to turn out springs in the short time that has elapsed since the present company took charge of the property. Notwithstanding the difficulties to be overcome, the work has been pushed forward and the concern is now in good running order and in position to turn out on an extensive scale both elliptic and coil springs promptly.

The plant consists of between four and five acres of ground admirably situated for manufacturing purposes, having first-class railroad and river connections. The main building, which is used for manufacturing, is 444 ft. long by 112 ft. wide, giving ample room for the elliptic department on one side, and the coil department on the other. The building is equipped with cranes for rapid and economical handling of material, has runway for cranes on both sides and has facilities for unloading three carloads of material at one end and loading the same with finished product at the other. The building is equipped with furnaces, machinery and appliances of the most modern type and the making of springs is reduced to a science. The building used as the boiler house, engine room, power house, machine shop and blacksmith shop, is about 300 ft. long by 80 ft. wide, and is equipped with all the latest appliances in each department. In addition to these two large buildings, there are several others of smaller dimensions used for storehouses and other requirements. It would require but a glance from one who is familiar with manufacturing plants to show that everything required for economical manufacturing has been considered and under the progressive and intelligent direction which will be given this concern by men of long experience in the spring business, success cannot fail to come to its organizers.

The president of the company, Mr. D. C. Noble, was for 21 years in active management of the old A. French Spring Co., and much of the success of that concern is said to be due to his wise and able handling of its affairs. The Vice-President of the company, Mr. L. C. Noble, was for 15 years western manager of the A. French Spring Co., in Chicago, and in addition to being a expert in mechanical lines, is also a man of large experience in business and has few equals at the present time in mechanical knowledge and business. Mr. John Proven, who was for 15 years general superintendent of the A. French Spring Co., has now severed his connection with that concern and goes with this company as its superintendent in charge of manufacturing. The company has also been able to not only enlist many of the officials of the late A. French Spring Co., but that they have also secured the co-operation of a large number of the mechanics and skilled workmen of that company, so that all departments of the mill are in charge of men of marked experience and ability in the spring business.

The accompanying illustration shows something of the size of the plant and the facilities for handling its product and that it is on a solid basis materially. It is also strong financially, and with its advantages embodying plant, money and men, it is in position to turn out a large product of high quality.

TECHNICAL.

Manufacturing and Business.

David Sloan, formerly Chief Engineer of Construction of the Illinois Central, is now Chief Engineer of the McArthur Brothers Co., contractors, Chicago, Ill.

The Comfort Car Seat Co., St. Louis, Mo., has been incorporated with $100,000 capital, by Ira C. Hubbell, W. H. England, Geo. Y. Floyd, R. A. Bull and O. F. Ledford.

The Commonwealth Steel Co., St. Louis, Mo., has received an order from the National Ry. of Mexico to supply separable body bolsters and truck bolsters for 500 cars.

The National Malleable Castings Co. desires mention to be made that the National dead lever guide and brake rod jaw, illustrated in our issue of April 10, page 264, are patented.

The Walter A. Zelnicker Supply Co., St. Louis, Mo., has 40 50,000-lbs. gondola cars to dispose of. They were built by the Pullman Company, are of one design, and are said to be in good condition.

The Independent Railroad Supply Co., Chicago, has recently received new machinery for its mill, enabling more prompt and rapid delivery of product. Last week the company shipped 12 carloads of its Chicago four-flange open hearth billet tie plates.

The Maryland Supply Co., of Baltimore, Md., has been incorporated in West Virginia, with $100,000 capital, by Alfred W. Gieske, Chas. A. Inglis, Gustav Gieske, Hardy C. Gieske and Albert R. Stuart, Baltimore Md., to make and deal in railroad supplies.

R. A. Bagnell, heretofore Western Manager of the Pocket List of Railroad Officials, and W. E. Magraw, Manager of the Monthly Official Railway List, have bought the latter publication from the Railway List Company. The headquarters will remain in Chicago.

The American Machinery Co., Willoughby, Ohio, has sold to the American Car & Foundry Co. for use at the Detroit, Mich.; Berwick, Pa., and St. Charles, Mo., shops, nine heading and rivet-making machines. Eight of these machines are for service in the steel car shops.

The Commonwealth Railway Supply Co., Chicago, E. B. Pickhardt, President, which is agent for the Vanderbilt brake-beam, has secured the order for the brake-beams for the 1,000 100,000-lb. steel cars now building for the Chicago, Burlington & Quincy by the Standard Steel Car Co.

Allan F. McIntyre, for many years with the Cambria Steel Co. and other structural steel mills, has bought an interest in two structural steel plants in Chicago. He has opened offices at 510 Monadnock Bldg. to contract for and sell all classes of both plain and fitted structural material for building and other purposes, including plate and tank work.

W. O. Duntley, Vice-President and General Manager of the Chicago Pneumatic Tool Co., reports a largely increased use of pneumatic tools among the large English and German ship owners, so that at the present time it is exceptional to find the old hand methods employed. The foreign plants of the company are taxed to their utmost capacity to fill orders.

The Welded Steel Barrel Corporation, Detroit, Mich., makes three styles of 54-gallon black steel barrels. They have all seams welded to form an absolutely air-tight, seamless vessel. The advantages claimed for them include absence of cooperage, convenience for transportation, storage and handling, ease of cleaning and the fact that the contents of the barrel may be heated, rendering heavy fluids within easy of removal. Welded steel drums of 110 gals. capacity are also made in three styles like the barrels.

T. L. Condron, M. Am. Soc. C. E., has been made the Chicago representative of the St. Louis Expanded Metal Fireproofing Company for the States of Indiana, Illinois, Wisconsin and Michigan for the sale of its corrugated steel bars for reinforcing concrete. He will continue to represent the Pittsburgh Testing Laboratory Ltd., in Chicago. James A. Lister has been appointed Chief Inspector at Chicago for the Pittsburgh Testing Laboratory, Ltd., and will have charge of all work under the laboratory's inspection in the Chicago district.

Iron and Steel.

The Whiting Foundry Equipment Co., Harvey, Ill., is reported to have increased its capital from $270,000 to $400,000.

The Wm. Adams Foundry Co., Philadelphia, Pa., has been incorporated with $150,000 capital by Wm. Adams, J. K. Bougher, W. H. Hunt and E. T. Dinlay.

Thomas Morrison, General Manager of the Edgar Thomson Steel Works (United States Steel Corporation), has resigned his position, to take effect June 1.

The Astoria Steel Co. has been incorporated under the laws of New Jersey with $800,000 capital. The incorporators are Charles A. Greene, Gerald A. Griffin and Joseph Gerrardt, East Orange, N. J.

The Tula Iron Company has been incorporated with $2,500,000 capital, by Wm. V. Snyder, Jr., Fred'k C. Bates and Michael F. Reardon, of 15 Exchange Pl., Jersey City, N. J., to make structural iron and steel.

The Buffalo & Susquehanna Iron Company, Buffalo, N. Y., has elected the following officers: William A. Rogers, President; Frank H. Goodyear, Vice-President; Charles W. Goodyear, Second Vice-President; Hugh Kennedy, General Manager.

Benjamin F. Jones, Sr., member of the advisory board and for many years President of the Jones & Laughlin Steel Co., died at his home in Allegheny on May 19. Mr. Jones was born in Claysville, Pa., Aug. 9, 1826. He first became interested in the iron business in 1847.

Signaling.

The Michigan Central has ordered from the Union Switch & Signal Co., Pittsburg, Pa., 100 Union electric motor semaphore signals, 90 of which are to be one-arm and 10 two-arm. These signals, with the necessary batteries, instruments and other fixtures, are ordered for the purpose of extending the automatic block system on the company's main line.

Electric Speed Recorder.

A new speed recorder designed for measuring the speed of trains consists of a small alternating current dynamo driven by the axle. The current for exciting the field coils is supplied by a battery of storage cells. The current generated is led into two two-pole magnets; and in one of the circuits is placed an inductive resistance giving a retardation of phase of about 90 deg. The two magnets act upon an armature, their action being opposed by a spring. The deflection corresponds to the speed at which the generator is driven and is shown by a needle on a scale. The apparatus is made by Siemens & Halske, of Berlin.

The Simplon Tunnel.

The delay caused by the water in the southern approach of the Simplon Tunnel is about to cause a new problem. The meeting from the two directions was planned to be at the middle of the mountain, and this is to be the summit of the tunnel, the incline in the two directions being sufficient to drain the tunnel. Now the excavation is likely to reach this point from the north next October,

while from the south the work is months behind. If the work is prosecuted from the north after the center is reached, the water must be pumped over the summit at considerable expense; and if the excavation is stopped at the center, there must be a further serious delay in completing the work.

Chicago Pneumatic Tool Co.

At a recent meeting of the directors of the Chicago Pneumatic Tool Co., held in New York, the business affairs of the company were carefully considered and found to be in satisfactory condition. The increasing demand upon the working capital of the company due to the growth of business caused a decision to create a larger surplus. It was therefore thought best to fix the dividend rate for the current year at 7 per cent., although the earnings, it was said, have been large enough to permit an 8 per cent. dividend. For the first quarter of the current year a dividend of 1¾ per cent. was declared, payable on June 5 to stockholders of record May 25. The European business is conducted by the Consolidated Pneumatic Tool Co., an English concern, the stock of which is owned by the Chicago company. The growth of the European business has necessitated an increase of shop facilities and of the working capital. A new factory is now building in Scotland.

High Speed Tests in Germany.

The company for experimenting with high speed electric railways after carrying out a number of tests on the Prussian Government military railroad between Marienfelde and Zossen was forced to abandon its work last year, as the track was found to be insecure at the high speeds attained. The Prussian Government has now authorized an appropriation for improving the roadbed, and work is to be begun this spring so that trials can be made this summer. The rails are to be No. 8b of the Prussian standard, weighing 82 lbs. per yard and 39 ft. 4 in. long. They are to be laid on 18 wooden ties per rail with guard rails placed inside the carrying rails and on a somewhat higher level. The company is making some improvements in its cars and apparatus to be ready for the coming trials. The Prussian Government is to make some high speed tests with steam locomotives on the same road, and direct comparisons can be made between the two methods of traction.

A Secret Service Agency.

The Edward Smith Company, General Agents, Detroit, Mich., has established a system having for its object the elevation of the motive power and other departments of railroads to the highest possible standard, and the reduction of expenses to the lowest consistent minimum. It is claimed already to have been successfully applied on several of the larger railroads. It consists primarily of a special secret service division employing expert mechanical agents who enter the shops of the railroad as regular employees. These agents investigate carefully the conditions of the various shops to discover all defects. They secure full details, and furnish complete reports of such investigations, with recommendations for betterment. These reports are so prepared that the executive official can readily comprehend the condition of affairs and suggestions for rectification, without having a practical knowledge of the details of the department. Edward Smith is Vice-President and General Manager of the company.

German Car Orders.

The Prussian State Railroads have prepared their orders for cars for the current fiscal year. The Berlin Direction has charge of making the contracts, which will be given to the car-works which have heretofore done work for the system. There are to be 476 new passenger cars, 62 baggage cars, 3,920 freight cars, and 30 reserve car-trucks. The noticeable feature is the extent to which the American truck system (eight-wheeled cars) prevails for passenger cars, where not many years ago they were almost unknown. The fourth-class cars are without trucks (six-wheeled) and are 217 in number; but while there are 138 eight-wheeled third-class compartment cars, 40 eight-wheeled cars with both first and second-class compartments, 40 eight-wheeled with compartments for all the three upper classes, and 62 eight-wheeled baggage cars, there are ordered but 41 six-wheeled cars with second and third-class compartments. About one-fourth of the freight cars are to have brakes. Only 1,000 of them will be box cars, and 800 coal cars. The cars are all to be delivered by the end of next March. The amount of the order may be better appreciated by the acquisitions of freight cars by the Pennsylvania Railroad Co. in 1902, which amounted to 6,669 cars, whose average capacity, doubtless, was nearly treble that of the Prussian freight cars, the latter being about 33,000 lbs., while the Pennsylvania orders for the year for all the lines it controls amounted to 12,000 cars.

A Novel Method of Repairing a Casting.

In a paper read before the French Society of Civil Engineers Mr. Jules Garnier describes a new and ingenious method of repairing a cracked casting.

The water in the jacket of his automobile cylinder froze and cracked the outside casing. This is a fairly common accident in winter time and usually means that new cylinders must be fitted, which is tedious and expensive. Mr. Garnier reports that he has cemented wide cracks with a composition of sulphur, iron filings and salammoniac, but in the present case the crack was not open enough to allow the introduction of anything but a liquid which led to the idea of utilizing the property which the copper salts have of depositing metallic copper when in contact with metallic iron. The cylinder jacket had two openings for the circulation of the water. The cylinders being placed vertically over a zinc basin the lower opening was closed by a cork and the jacket filled with a slightly concentrated solution of sulphate of copper, through the upper opening. The solution leaked out rapidly through the cracks, collecting in the basin from whence it was poured back into the jacket. The leakage was rapidly reduced to a mere sweating so that it was sufficient to pour it back every hour. At the end of the day, air was pumped into the jacket, giving considerable pressure on the liquid. This slightly increased the sweating, but as the extruded liquid was nearly colorless, instead of being blue, it was obvious that the operation was nearly complete, and on the next day the cracks were perfectly tight and the cylinders were mounted and used. The chemical action involves the replacement of the iron along the edges of the cracks by copper from the solution, and it might have been thought that as a consequence there would be no closing of the cracks, the volume of copper deposited being replaced by an equal volume of dissolved iron. As a matter of fact the cracks were perfectly closed and the jacket would apparently have stood considerable water or steam pressure.

THE SCRAP HEAP.

Notes.

At Pittsfield, Mass., the town where William Craig, President Roosevelt's guard, was killed last year, the street railroad company has lately been fined $300 for violating the city ordinance limiting the speed of street cars to 10 miles an hour.

Montreal papers say that the Grand Trunk Railway is going to have libraries of 25 to 50 books each on a car in each of its through passenger trains. The books will be furnished by the Book Lovers' Library of Philadelphia and will be free to passengers on cafe-parlor cars and Pullman cars. The books will be changed every three months.

The Governor of New York has vetoed the item of $92,500 in the Appropriation Bill for the State Railroad Commission, this sum being intended for abolishing highway grade crossings. The Board has at its disposal a considerable unexpended balance, so that the important works now under way will not be delayed, but a number of expected improvements will have to be postponed.

Robert Westcott, in a suit against the Delaware, Lackawanna & Western, has received a verdict of $80,000, affirmed by the New York State Court of Appeals, for damages for premature termination of a contract which he had with the railroad company to manage its milk transportation business. The reports say that Westcott increased the business from 40,000 cans a year to three million cans.

Philadelphia papers state that 13 through passenger trains now pass through that city over the Pennsylvania Railroad without entering Broad Street station. Eleven of these are New York-Washington trains and the other two are the Chicago Limited, westbound, and the Seashore Limited, eastbound. The Congressional Limited from Washington to New York is said to make no stop; which means, we suppose, that one engine hauls the train from Wilmington to Jersey City.

The Interstate Commerce Commission has postponed to June 8 the further hearing in its inquiry into the rates on anthracite coal from the mines to the seaboard, on the complaint of W. R. Hearst. This delay is for the purpose of getting an order from the United States Circuit Court, which has just been applied for, to compel officers of the Reading, the Erie, the Lehigh Valley and other roads to produce certain contracts, with railroads and with coal companies, which these officers refused to produce at the hearing held a few weeks ago. It is said that this is the first time that the Commission has asked a Court for an order of this kind.

The Union Pacific, making answer to the Interstate Commerce Commission, under the order of that body investigating rebates, says that it has an agreement with the Midland Elevator at Kansas City and the Omaha Elevator Co. at Council Bluffs, both being representatives of Peavey & Co., under which the company pays 1¼ cents per 100 lbs. for all grain passing through the elevators. It is stated that the elevators are necessary to the economical and profitable handling of the grain business, and the contracts were made with Peavey because of this necessity. The allowance is declared to be not excessive; nor does it discriminate against other grain dealers.

On May 21 the workmen of the Pennsylvania Railroad pulled down the lines of the Western Union Telegraph on about 1,500 miles of the right of way of the railroad, to the extent of 60,000 poles and 15,000 miles of wire. This action followed the decision of the United States Court, two days before, dissolving the temporary injunctions which had restrained the road from ousting the telegraph company. Most of the Western Union property along the main line of the railroad between the Delaware River and Pittsburg, along the line to Washington and on the West Jersey & Seashore was destroyed. An officer of the Pennsylvania says that the telegraph company had, under its contract, six months' notice in which it might have removed its lines by its own workmen, and that this clause empowers the railroad to take down the lines at the telegraph company's expense. He says, also, that the road had offered to buy the lines at a fair valuation. It was necessary to get these poles and wires out of the way so that the railroad company could carry out its contract with the Postal Co., which has been granted the right to put up new poles and wires.

Difficulty in Pumping California Oil.

The Standard Oil Company has lately finished an 8-in. pipe line for the conveyance of oil from Bakersfield, Cal., north 280 miles to San Francisco bay. At intervals of 10 miles there are pumping engines for forcing the fluid to the next station; and at every station there is a steel tank of 37,000 gallons capacity, fitted with about 10,000 ft. of 2 in. steam pipes, in which the thick oil is to be heated to 120 deg. in order to make it flow freely, as it is of the consistency of heavy molasses. It is found that even this is not enough; and that the system will not work on account of the viscosity of the oil. The only remedy so far proposed is a number of additional stations for heating (and pumping).—*San Francisco Report.*

A Fast Run by the Twentieth Century Limited.

On Monday, May 25, the Twentieth Century Limited express of the Lake Shore & Michigan Southern, westbound, having lost an hour and 32 minutes east of Cleveland, was run from Toledo to Elkhart, 133.4 miles, in 114 minutes, equal to 70.2 miles an hour. This is much better speed than was made by the special train of three cars (eastward) which made the great record over this line in October, 1895. The rate of that run from Elkhart to Toledo was 64.2 miles an hour. The newspaper reports which give this Twentieth Century record say that the entire distance from Cleveland, Ohio, to Dune Park, Ind., 307 miles, was traversed in 292 minutes, equal to 63.1 miles an hour. The train reached Chicago on time. It consisted of four heavy cars and was drawn over the Toledo-Elkhart division by engine 603. On this division there is one tangent 70 miles long.

English Dividends in 1902.

The *Economist* prints the following comparison of dividends paid in England in 1902 and in 1901, showing general increases:

	1902 Dividend.	1901 Dividend.
Caledonian	4	3⅝
Great Eastern	3⅛	2⅝
Great Northern	3¾	2⅝
Great Western	5⅝	4
Lancashire & Yorkshire	4	3⅝
London & North-Western	6	5
London & Southwestern	6	5½
London, Chatham & Dover	3½	2 39/40
London, Brighton & South Coast	5⅝	4¾
Midland	5¼	4⅝
North British	1⅞	½
North Eastern	5¾	5¾
South Eastern	2	2 5/16

Railroad Through Galilee.

The Ottoman Government has bought the English concession for a line of railroad from Haifa to Damascus. It is intended to build a railroad through Galilee to Mzerib, by way of Beisan, connecting at Mzerib with the Damascus-Mecca line. On April 5 five German civil engineers, employed by the Turkish Government, arrived in Haifa, and on the 11th the vali of the province of Beirut unveiled a monument in commemoration of the beginning of operations. The estimated cost of this line from Haifa to Mzerib, by way of Beisan, is $2,000,000. It is to be a narrow-gage line (about 40 in.). The Damascus-Mecca line has now reached a point east of the Dead Sea. I have reason to believe that this railroad, instead of running to the Hejjaz, including Medina and Mecca, will take from Ma'an a southwesterly direction straight to the Gulf of Akaba in the Red Sea. While the line will be built for strategical purposes, it can hardly fail gradually to develop the trans-Jordan country—hitherto another Tibet—by bringing it into touch with the outside world.—*U. S. Consular Report.*

Locomotives, Bridges and Lions.

Sir George Whitehouse, manager and chief engineer of the Uganda Railroad, who has just returned to London after seven and a half years spent in constructing the line, speaks highly of the American locomotives and bridges used. He said:

We have 36 American and 34 British main line engines. The experiment with the American locomotives proved entirely satisfactory. They are 10 per cent. cheaper, and, although their finish is not so perfect, they are more suitable for a mountain railway, like the Uganda road, because they are not so rigid and take the curves more easily.

Of the steel viaducts along the line 26 are of American and eight are of English make. The American viaducts are excellent, but the contractors were greatly behind time, and took a year, instead of seven months, to erect them.

Sir George mentioned among the difficulties of the construction work the scare arising from the presence of many lions along the route. No less than 27 employees are known to have been carried off by lions.

London, Brighton and South Coast New Turbine Service.

The new turbine steamer recently ordered from Wm. Denny & Bros., of Dumbarton, Eng., for service between New Haven and Dieppe, is to be 280 ft. long, 34 ft. broad and 22 ft. deep, with a gross tonnage of 1,100 tons. This vessel will be, in general design, like the "Arundel" built in the year 1900 by the same ship builders, with the exception that the speed will be increased about half a

knot. The three turbine engines on this new steamer will be similar to the one on the "King Edward," which was recently built by Wm. Denny & Bros. for service on the Clyde. There are one high pressure and two low pressure engines, the high pressure one being in the center line. Each drive one shaft, the center shaft having one propellor, and the two side shafts two propellors each. In maneuvering, the center shaft runs free. The two side shafts then take the place of the ordinary twin screws. The maneuvering power is just as good as in ordinary twin screw steamers, while in going astern there is none of the vibration which is to be felt even in the more modern twin screw vessels.

English Railroad Casualties in 1902.

The number of passengers killed in train accidents in Great Britain and Ireland during the year ending December 31 last was six; of employees four and of other persons two. The numbers of these classes injured were 732, 110 and 12, respectively; making a total of 12 killed and 854 injured. The corresponding figures for 1901 were 11 persons killed and 637 injured. It will be remembered that in 1901 no passenger was killed in a train accident. Including accidents from all causes, the number of persons killed in 1902 was 1,096 and of injured 6,661. The 1,096 killed in this second table includes 129 passengers, 447 employees and 520 other persons. Of the 520 "other persons" 421 were trespassers, of whom 135 were suicides. The tables from which the foregoing figures were taken do not include accidents to passengers on station platforms, or to employees loading freight cars, or working in freight houses, or in engine houses; getting on or off engines or vehicles at rest, stumbling while walking on the track, and many other causes. Adding the accidents occurring in this miscellaneous class, the total number reported by the railroads is 1,171 killed and 17,814 injured.

The Chicago Engineering & Constructing Company.

The Chicago Engineering & Constructing Company succeeds to the established engineering and contracting business of Weston Brothers, with offices in the Merchants Loan & Trust Building, Chicago. This firm was organized two and a half years ago to carry on a general engineering and contracting business, paying special attention to examinations and reports on steam and electric roads, and has done construction in many instances. Some of the recent work includes the designing of the intramural transportation system for the St. Louis Exposition; also assistance rendered to Bion J. Arnold in the preparation of his report to the Local Transportation Committee of the Chicago City Council, for which they received due credit in the report.

The officers of the company are Charles V. Weston, President; George Weston, Vice-President; George A. Yuille, Secretary and General Manager; Harvey B. Hicks, Counsel. Addison E. Wells, Fred A. Wells and Edward B. Burling, together with the officers, make up the Board of Directors. The company is now supervising the building of the electric road from Rockford to Freeport, Ill., and is engaged on plans and specifications for extensions of some existing lines.

Poor Showing of German Steamship Lines.

Consul Walter Schumann, under date of April 28, 1903, reports as follows:

The Hamburg-American Line declared a dividend of 4.5 per cent. for the year 1902, as against 6 per cent. in 1901. The North German Lloyd decided not to pay any dividend for 1902; for 1901, the company declared 6 per cent. The German Steamship Co. Hansa paid 6 per cent., as against 8 per cent. for 1901. The Kosmos Co. declared a dividend of 9 per cent. for 1902, as against 12 per cent. in 1901. The Hamburg-South American Steamship Co. was unable to declare a dividend for 1902; for 1901, the company paid 4 per cent. The German East African Line, which paid 2 per cent. for 1901, intends to declare 2.5 per cent. for the past year. The German-Australian Steamship Co. will declare 5 per cent., as against 8 per cent. for 1901. The German Levant Line will be able to declare only 3 per cent. for the past year, as against 6.5 per cent. for 1901. The Bremen Steamship Co. Argo is unable to declare a dividend for the past year; for 1901, it paid 3 per cent. The Bremen Steamship Co. Neptune has declared a dividend of 5 per cent., as against 7 per cent. for 1901. The Flensburg Steamship Co. was unable to declare a dividend for 1902; for the year previous, the company paid 6 per cent.—*U. S. Government Consular Reports.*

Rewards for Bravery and Fidelity.

Four heroes received handsome tokens yesterday in recognition of their bravery. The presentations were made in the office of R. E. McCarty, Superintendent of the Pittsburg Division of the Pittsburgh, Cincinnati & St. Louis Railway. The recipients of the gifts were James E. Herron, yardmaster; Thomas R. White, assistant yardmaster; Michael Carter, section hand, all of Sheraden yards, and Charles Carlson, a fireman. The tokens were in the form of four handsome gold watches, and each bore an inscription explaining why the recipients were thus remembered.

On March 26 it was discovered that a tank car filled with naphtha had in some manner become ignited in the Sheraden yards, but a short distance from the spot where on May 12, 1902, five cars of this material caught fire and exploded, killing 28 people, burning 600. The sight of flames leaping into the air from the cupola of a car of naphtha caused a veritable panic among the men at work in the yards, and they ran for their lives in all directions. Those engaged in the adjoining buildings of the company rushed out and hurried to distant places of safety. Not so with Herron, White and Carter. Herron leaped into the nearest locomotive and drew the other cars away from the blazing tank, leaving it isolated. White seized an armful of bagging, in which waste had been packed, and with this climbed on top of the burning car. He was followed to this dangerous position by Carter, and together they threw the bagging about the blaze and endeavored to smother it. Yardmaster Herron ran the engine alongside the burning car, and from the water supply in the tender, moistened the big rags that were being applied to the flames. In this manner the blaze was smothered out, and no damage resulted.

The three men went modestly back to their ordinary duties and said nothing about their wonderful act, but it was brought to the attention of the officials, and General Manager G. L. Peck gave orders that the deed be recognized in a substantial manner. He also gave orders that a similar token be awarded to Charles Carlson.

Carlson's deed of bravery was of a different nature. He was firing for Engineer John Smith on passenger train No. 5. While the train was thundering along at full speed, Smith leaned too far out of his cab window, and was struck by a mail crane at Black Run, and instantly killed. Carlson was busily engaged with his work and did not witness the terrible accident, but when the train ran past a signal, he leaped across the cab and quickly brought the train to a standstill.

These four heroes of the rail were summoned to appear at the Superintendent's office yesterday morning, and in a brief speech Superintendent McCarty presented the watches. The recipients were taken by surprise and for a time they were almost overcome.—*Pittsburg Post*, May 16.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

American Association of Dining Car Superintendents.
Next meeting at Hotel Victory, Put-in-Bay, Ohio, July 22.

American Association of Traveling Passenger Agents.
The annual meeting will be held at the New Charles Hotel, New Orleans, La., November 10 to 12.

Association of Railway Claim Agents.
The fourteenth annual meeting of this Association will be held at the Cataract Hotel, Niagara Falls, N. Y., beginning Wednesday, June 3, at 10 a.m.

American Association of Local Freight Agents' Associations.
The sixteenth annual convention will be held at the De Soto Hotel, Savannah, Ga., June 9 to 12. B. L. Bugg, Chairman Committee on Arrangements.

New York Railroad Club.
The following changes have been made: W. L. Derr, Acting Chief Engineer, Erie R. R., has been made Third Vice-President to succeed W. F. Potter, resigned; R. M. Dixon, Vice-President, Safety Car Heating & Lighting Co., for a number of years Chairman of the Finance Committee of the Club, has been made Treasurer, succeeding C. A. Smith. O. C. Gayley, Manager of Sales (Eastern District), Pressed Steel Car Co., becomes a member of the Finance Committee.

PERSONAL.

—Mr. S. G. Ramsey, General Superintendent of the United Railroads of Yucatan, died May 19, at Merida, Yucatan, Mexico.

—General Manager Matsmoto, of the Japanese State Railroads, died in Tokio March 18. He received his engineering training in the United States, had traveled in Europe and was a very capable railroad official.

—Mr. C. N. Sterry, Solicitor of the Atchison, Topeka & Santa Fe Coast Lines, died at his home in Los Angeles, Cal., May 22. He was for a number of years General Attorney for the Atlantic & Pacific and later Solicitor for its successor, the Santa Fe Pacific.

—Mr. J. H. Rice, of Ashtabula, Ohio, who has for the past six years been with the civil engineering corps of the Lake Shore & Michigan Southern, and who had charge of the construction of the new Collinwood shops, has resigned, to become Superintendent of Construction of the Dow Chemical Company of Midland, Mich., with office at Mt. Pleasant.

—Mr. William Hoppe, Superintendent of Bridges and Buildings on the Chicago, Burlington & Quincy, was instantly killed at Fairfield, Iowa, May 19. He had been connected with the Burlington System for many years and left Burlington (his home) on the morning of his death, in company with a party of officers of the road, on an inspection trip. At Fairfield Mr. Hoppe stepped from a car directly in front of a car going in the opposite direction.

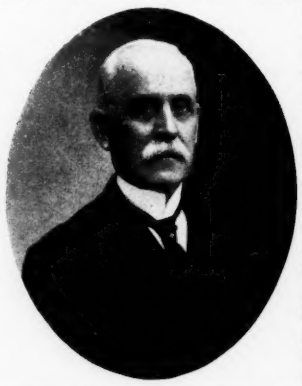
—Mr. Elias E. Hughes, the new Superintendent of the Pere Marquette at Grand Rapids, was born at Racine, Wis., in 1859. He began his railroad service with the Chicago & North Western in 1876, and remained with this company in various capacities until 1897. In 1899, he was appointed General Manager of the Davenport, Rock Island & Northwestern. From 1901 to 1903, Mr. Hughes was Vice-President and General Manager of the Ozark & Cherokee Central and on the first of this month became Superintendent of the Pere Marquette.

—Mr. Edgar E. Calvin, whose promotion from General Superintendent to Assistant General Manager of the Oregon Short Line, is announced, is 45 years old. His railroad service dates from 1873, when he entered the service of the Indianapolis, Cincinnati & LaFayette as a telegraph operator. In 1877 he went to work for the Union Pacific as operator and subsequently was station agent, train despatcher and trainmaster. In 1887 he went to the Missouri Pacific as a Division Superintendent, but in 1891 was again on the Union Pacific as Superintendent of the Idaho Division. In 1895 he left the Union Pacific to go to the International & Great Northern as General Superintendent, which position he resigned in 1897 to go to the Oregon Short Line.

—Mr. Owen J. Travis, Superintendent of Bridges and Buildings of the Colorado & Southern, has been a bridge man over 30 years, having begun with the Keystone Bridge Company. He worked for the St. Louis Bridge Company for a time and in 1881 went to the Wabash, St. Louis & Pacific as General Foreman of Bridges and Buildings of the Western Division. Three years later he was appointed General Foreman of Bridges and Buildings for the Texas & St. Louis. In 1884 he returned to the Wabash. Five years later he resigned to become Superintendent of Bridges and Buildings of the Iowa Central, and in 1894 became Superintendent of Maintenance on the Elgin, Joliet & Eastern. In 1897, he went to the Illinois Central as Superintendent of Bridges, which position he held until May 1, this year, when he resigned to take his new position as above.

—Mr. William A. Crafts, Secretary of the Massachusetts State Railroad Commission, has resigned that office and on June 1, will retire to private life. This action is taken on account of Mr. Crafts' advanced age and somewhat impaired health. He has held this office from the establishment of the Commission in 1869, with the exception of a few months, when General Butler was Governor, and has become known throughout the world. As everybody knows, the Massachusetts Commission has been the model state railroad-regulating body of the country, and in 1883 Mr. Crafts wrote a pamphlet, which was published by the *Railroad Gazette*, describing the first ten years of the Commission's work. He has the peculiar qualities of industry, an unfailing memory, methodical habits and uniform courtesy which go to make the ideal public secretary. The popularity of Mr. Crafts in his own State and his efficiency in his office are indicated by promptness with which he was reappointed to the secretaryship after the expiration of Governor Butler's term (1884), the displacement of Mr. Crafts having been due wholly to political reasons.

—Mr. Orry M. Shepard, who, on June 1, goes from New York to New Haven to become General Superintendent of the New York, New Haven & Hartford, has been connected with this company and the New York & New England for the past 23 years. He is a native of Cleveland, Ohio, and was born in 1842. In 1863 he entered the service of the United States Military Telegraph and Railway Service and was engaged in telegraphy and train despatching until 1870, when he became Master of Transportation and Assistant Superintendent of the Gilman, Clinton & Springfield. Then for six years he was Assistant General Superintendent of the St. Louis & Southeastern, and, in 1880, went to the New York & New England as Superintendent. Two years later he went to the New Haven road and has been in the service of that company throughout the 21 years since that time, occupying the positions of Division Superintendent, Superintendent, Assistant to the President and General Superintendent. He has been Superintendent of the New York Division (the place which he now leaves) since 1890.



ELECTIONS AND APPOINTMENTS.

Arkansas Southern.—J. C. Nolan, Master Mechanic, has been appointed Superintendent, also.

Canadian Pacific.—Wm. Downie, heretofore Superintendent of the Pacific Division at Nelson, B. C., has been appointed General Superintendent of the Atlantic Division, with office at St. John, N. B.

C. W. Burpee, heretofore Roadmaster, has been appointed Superintendent of the Atlantic Division, with headquarters at Brownville, Me., succeeding W. K. Thompson, promoted.

Chicago, Rock Island & Pacific.—J. A. Sandberg, heretofore Assistant Auditor of Disbursements of the Great Northern, has been appointed Auditor of Disbursements of the C., R. I. & P., with headquarters at Chicago, Ill., succeeding H. F. Morris, assigned to other duties.

The jurisdiction of L. M. Allen, General Passenger Agent of lines east of the Missouri River, has been extended to include the lines west of the Missouri River.

Delaware & Hudson.—A. I. Culver, Comptroller, has been elected Third Vice-President; office at New York city.

Erie.—C. E. Fuller has been appointed Assistant Mechanical Superintendent, and W. C. Hayes has been appointed Assistant Mechanical Superintendent, succeeding George Donahue, resigned.

Great Northern.—See Chicago, Rock Island & Pacific.

Illinois Central.—J. E. Hague has been appointed Superintendent of Bridges, with headquarters at Chicago, Ill., succeeding O. J. Travis. F. E. Place, Master Mechanic, with office at Chicago, Ill., has resigned.

Lehigh Valley.—F. E. Knorr has been appointed Assistant Treasurer, with office at Philadelphia, Pa.

New York, New Haven & Hartford.—Edgar L. Somers, heretofore General Western Freight Agent of the New York Central & Hudson River, has been appointed Freight Traffic Manager of the N. Y., N. H. & H., with headquarters at Boston, Mass., succeeding J. M. Williams, effective June 1.

Oregon Short Line.—E. E. Calvin, heretofore General Superintendent, has been appointed Assistant General Manager, with headquarters at Salt Lake City, Utah. The office of General Superintendent has been abolished.

Pennsylvania.—At a meeting held May 27, of the Directors, J. R. Wood was appointed Passenger Traffic Manager, which is a new office. George W. Boyd, Assistant General Passenger Agent, was promoted to the office of General Passenger Agent, to succeed Mr. Wood. J. B. Thayer, Jr., was elected Fifth Vice-President, a new office. J. W. Coneys was appointed Assistant Superintendent of the Cleveland & Pittsburgh Division. Other changes were made by the Directors as follows: George D. Dixon, Freight Traffic Manager; Edwin P. Bates, General Freight Agent; Robert C. Wright, Assistant General Freight Agent; Joseph C. Searles, General Coal Freight Agent; Rufus M. Pile, Assistant General Passenger Agent; Joseph T. Richards, Chief Engineer of Maintenance of Way; Alexander C. Shand, Engineer of Maintenance of Way; Robert M. Patterson, Superintendent Freight Transportation; Charles M. Sheaffer, Superintendent of Passenger Transportation; Herbert B. Jaggerd, General Agent at Pittsburg; George W. Walker, Assistant Treasurer, succeeding P. F. Hunter, resigned, and Alexander Geiser, Superintendent of Telegraph. All appointments take effect June 1.

Pennsylvania Company.—J. W. Coneys, heretofore Trainmaster, has been appointed Assistant Superintendent of the Cleveland & Pittsburgh Division.

Public Service Company.—W. W. Wheatly, formerly with the Brooklyn Rapid Transit Company, has been appointed Superintendent of the Transportation Department of the P. S. C.; D. Farrand has been appointed Superintendent of the Electrical Department, and E. H. Whitcomb, Superintendent of the Gas Department. The main offices are at Newark, N. J. The Public Service Company is a new company which has been organized to operate the following street railroads in New Jersey: The North Jersey Street, the Jersey City, Hoboken & Paterson Street, the Elizabeth, Plainfield & Central Jersey, the Orange & Passaic Valley, and the United Electric Company. The P. S. C. will also operate extensive lighting and power plants.

St. Louis, Iron Mountain & Southern.—G. L. Bonney has been appointed Superintendent of Dining Car Service.

St. Paul Union Depot.—A. W. Trenholm, General Manager of the Chicago, St. Paul, Minneapolis & Omaha, has been elected President of the Union Depot Company.

Tennessee Central.—O. M. Laing has been appointed Secretary, with office at Nashville, Tenn., succeeding W. E. Eastman.

Wisconsin Central.—G. T. Huey has been appointed Assistant General Freight Agent, with headquarters at Minneapolis, Minn.

LOCOMOTIVE BUILDING.

The Atchison, Topeka & Santa Fe is having 26 locomotives built at the Baldwin Works.

The Chicago & North Western is having 26 locomotives built at the Baldwin Works.

The El Paso & Southwestern has ordered four simple "Pacific" (4-6-2), three simple consolidation (2-8-0), and two simple Decapod (2-10-0) locomotives from the Baldwin Locomotive Works; and three simple switching and two simple 10-wheel (4-6-0) freight locomotives from the American Locomotive Co. The (4-6-2) locomotives will weigh 224,000 lbs., with 142,000 lbs. on the drivers, and have 22 x 26 in. cylinders. The (2-8-0) locomotives will weigh 183,000 lbs., with 166,000 lbs. on the drivers, and have 22 x 28 in. cylinders. The (2-10-0) locomotives will weigh 220,000 lbs., with 200,000 lbs. on the drivers, and have 23½ x 28 in. cylinders. The switching locomotives will weigh 124,000 lbs., and have 19 x 26 in. cylinders. The (4-6-0) locomotives will weigh 180,000 lbs., with 140,000 lbs. on the drivers, and have 21 x 28 in. cylinders. The special equipment for all includes: Westinghouse air-brake and Trojan couplers for (2-8-0) locomotives.

The Mexican International, as reported in our issue of May 15, has ordered five simple (2-8-0) locomotives from the Baldwin Locomotive Works for June and October delivery. These locomotives will weigh 190,000 lbs., with 170,000 lbs. on drivers. Cylinders, 22 in. x 28 in.; straight top radial stay boiler, with a working steam pressure of 200 lbs.; heating surface, 3,026.8 sq. ft.; 366 iron tubes, 2 in. in diameter and 15 ft. 1 in. long; carbon steel fire-box, 108 in. long and 72½ in. wide; grate area, 49.5 sq. ft.; tank capacity, 8,000 gal., and coal capacity, 14 tons. Special equipment includes Westinghouse air-brakes, hammered steel axles, asbestos sectional boiler lagging, steel brake-beams, cast-iron brake-shoes, Janney and Buckeye couplers, kerosene oil headlights, Nathan injectors, bronze journal bearings, U. S. piston rod and valve rod packings, Crosby safety valves, Leach sanding devices, Nathan triple sight-feed lubricators, Baldwin springs and steam gages, Standard cast-steel driving wheel and truck wheel tires and cast-steel wheel centers.

The Wabash, as reported in our issue of May 22, has ordered 12 simple (4-4-2) locomotives from the Brooks Works of the American Locomotive Co., for September, 1903, delivery. The locomotives will weigh 170,000 lbs., with 90,000 lbs. on drivers; cylinders, 21 in. x 26 in.; Standard extended wagon top boiler, with a working steam pressure of 210 lbs.; heating surface, 2,800 sq. ft.; 294 iron tubes, 2 in. in diameter and 16 ft. 4 in. long; fire-box, 102 in. long and 63 in. wide; grate area, 46.7 sq. ft.; tank capacity, 6,000 gal., and coal capacity 12 tons. Special equipment includes Westinghouse high-speed air-brakes, steel axles, Franklin Mfg. Company's boiler lagging, Damascus brake-beams, Gould couplers, Pyle National electric headlights, Ohio injectors, U. S. bronze journal bearings, Jerome piston rod and valve rod packings, Ashton safety valves, Leach sanding devices, Michigan sight-feed lubricators, Scott springs, Crosby steam gages, Gold steam heating equipment, Wabash bell ringers and brake-shoes, cast-steel wheel centers and Midvale tires for driving, truck and tender wheels.

CAR BUILDING.

The American Car & Foundry Co. has inquiries for 50 miscellaneous cars.

The Fort Smith & Western is having 300 freights built by the Haskell & Barker Car Co.

The Pere Marquette has ordered 10 eight-wheel caboose cars from the American Car & Foundry Co.

Westinghouse, Church, Kerr & Co. has ordered 10 box cars from the American Car & Foundry Co.

The Stearns Salt & Lumber Co. is having 30 freights built at the West Detroit Works of the American Car & Foundry Co.

The Atchison, Topeka & Santa Fe is having 300 freights built at the Terre Haute Works of the American Car & Foundry Co.

The South Fork Coal Mining Co. is having 150 self-clearing hopper cars of 1,000 lbs. capacity built at the Allegheny Works of the Pressed Steel Car Co.

The Westinghouse Electric & Mfg. Co. has ordered 10 flat cars from the Pressed Steel Car Co. These cars are to be equipped with structural steel underframing and are to have a capacity of 135,000 lbs.

The Chesapeake & Ohio is having 1,000 twin hopper gondolas built at the McKees Rocks Works of the Pressed Steel Car Co. The special equipment includes C. & O. standard arch-bar trucks, pressed steel bolsters and brake-beams, Miner draft rigging on 800 of the cars, and Sterlingworth draft rigging on 200, Chicago frictional side bearings, Westinghouse air-brakes and Pittsburg Spring & Steel Co.'s springs.

The Evansville & Terre Haute, as reported in our issue of May 22, has ordered 500 coal cars of 80,000 lbs. capacity from the Pullman Co., for September delivery. The cars will be 36 ft. long, 9 ft. 4 in. wide, and 10 ft. 3 in. high, to be built of wood, with wooden underframes. The special equipment includes: Pullman axles, Damascus brake-beams, Westinghouse air-brakes, National Railway brasses, Miner draft rigging and McCord journal boxes and lids.

The Chicago, Rock Island & Pacific, as reported in our issue of May 8, has ordered 22 vestibule passenger, three dining and 15 baggage cars from the Pullman Co., for delivery from October, 1903, to January, 1904. The passenger cars will be 60 ft. 8 in. long, 10 ft. 8 in. wide and 14 ft. 3¼ in. high, all outside measurements. The dining cars will be 70 ft. long, 10 ft. wide and 15 ft. ½ in. high, all outside measurements. The baggage cars will be 60 ft. 8¼ in. long, 10 ft. wide and 14 ft. 6½ in. high, all outside measurements. The special equipment for all includes: National-Hollow brake-beams; Christie cast-iron brake-shoes; Westinghouse air-brakes; Janney couplers; Forsyth curtain fixtures for passenger and dining cars; Pullman dust guards; Railway standard straight steam heating system for passenger and baggage cars; McCord journal box lids for passenger and baggage cars; Fletcher journal box lids for dining cars; Pintsch gas light; Standard steel platforms; Railway standard trucks; Pullman wide vestibules for passenger and dining cars, and McKee Fuller wheels.

BRIDGE BUILDING.

ALGONA, IOWA.—The Supervisors will build two steel bridges 64 ft. each, over Blue Earth River, and a 70-ft. steel bridge over Plum Creek. A. Ogren and E. Kunz, committee.

ALMA, CAL.—The Supervisors of Santa Clara County will receive bids until 11 a.m., June 2, at San Jose, Cal., for a stone and concrete bridge over Los Gatos Creek. John Roll, Chairman.

AUGUSTA, GA.—The Council is having an estimate made of the cost of masonry arches to replace 13 wooden bridges over the canal.

BAKER CITY, ORE.—The Oregon R. R. & Navigation Co., it is said, will build six new steel bridges between this place and Huntington.

BALTIMORE, MD.—Surveys are said to have been made for a steel bridge to be built by the Baltimore & Ohio over Big Monocacy River west of Dickerson.

BINGHAMTON, N. Y.—The Rockbottom bridge over the Susquehanna River, which has long been considered unsafe, recently collapsed under the weight of a loaded street car. The bridge will have to be replaced by a new steel structure.

BURNSIDE, KY.—The Pulaski County Fiscal Court has ordered a $20,000 bridge built over the south fork of Cumberland River.

CARTHAGE, TENN.—The Town Council has authorized $50,000 bonds for a bridge over Cumberland River.

CHEHALIS, WASH.—Bids will be received until 9 a.m., June 1, by the Auditor of Lewis County, for a 140-ft. bridge over Chehalis River, near Ceres Station, on the South Bend Branch of the Northern Pacific.

CHINOOK, MONT.—E. F. Sayre, County Clerk, Fort Benton, Mont., will receive bids until 10 a.m., June 4, for a Howe truss or combination bridge over Milk River at Bowes Ford.

COVINGTON, IND.—It is reported that the County Commissioners will receive bids June 5 for five iron bridges.

FARGO, N. DAK.—Arthur G. Lewis, County Auditor, will receive bids until 10 a.m., June 2, for a bridge over Red River of the North at Front street.

FULLERTON, NEB.—Nance County is said to have issued bonds for steel bridges over Loup River at Genoa, Palmer and Fullerton.

GRAND JUNCTION, COLO.—According to newspaper report, the Denver & Rio Grande R. R. will spend $150,000 rebuilding two bridges over Grand River between this place and Delta.

GRAND RAPIDS, MICH.—The time for receiving bids for the bridge over Grand River at Bridge street has been postponed from May 15 to June 5. This bridge is to be of concrete or concrete-steel, 448 ft. long and 66 ft. wide, and will consist of five arches. Joseph Emmer, President Board of Public Works. L. W. Anderson, City Engineer.

HARRISBURG, PA.—The City Engineer writes that nothing definite has been decided about the bridge reported to be planned to cross the Pennsylvania tracks at Walnut street, and that it will probably be a number of years before such a bridge can be built.

HAY, ONT.—Bids are asked until June 1 for the abutments and superstructure of the Sauble bridge.

HOLSTON, VA.—John C. Stanfield, Supervisor of Washington County, will receive bids until 3 p.m., June 15, for a 220-ft. steel bridge over Holston River.

ISLAND POND, VT.—It is reported that two overhead bridges, to cost from $30,000 to $40,000, will be built over the railroad tracks near Brighton to take the place of grade crossings.

LOWELL, MASS.—The Pawtucket bridge may be replaced.

MEADVILLE, PA.—Crawford County will build three new bridges.

MILWAUKEE, WIS.—The city is considering building a bridge at East Water street with the $150,000 recently raised by sale of bonds for a bridge to Jones Island.

NEW PHILADELPHIA, OHIO.—C. C. Frensell, County Auditor, will receive bids until noon, June 15, for a 262-ft. bridge over Tuscarawas River at Zoar station.

NEW YORK, N. Y.—H. Fernstrom, Chief Engineer, N. Y. C. & H. R. R. R., Grand Central Station, New York, will receive bids until 3 p.m., June 8, for building two double-track transfer bridges, with platforms and machinery complete, between piers 62 and 63, North River.

NORTH ADAMS, MASS.—Plans have been completed by the street railway company for a concrete-steel arch bridge at Braytonville.

OROVILLE, CAL.—Bids will be wanted June 6 for the steel bridge over the west branch of Feather River.

PHILADELPHIA, PA.—The Committee on Highways of the City Council has decided to order the Baltimore & Ohio R. R. to build bridges over its tracks in the Fortieth Ward; and has approved ordinances permitting the building of bridges over Thompson and Jefferson streets west of Thirty-first street, and over Naudain street west of Eighteenth street.

PLAINFIELD, N. J.—Bids will be received until June 2 for the bridge to be built by Union and Somerset Counties over Green Brook at Girard avenue.

POTTSVILLE, PA.—The bridge from Palo Alto to Port Carbon has been condemned and closed to traffic, and a new bridge will have to be built in its place.

QUINCY, FLA.—Bids will be wanted June 2 for a county bridge over Attapulgas Creek on Bainbridge Road.

ROCHESTER, N. Y.—H. Fernstrom, Chief Engineer N. Y. C. & H. R. R. R., Grand Central Station, New York, will receive bids until 3 p.m., June 1, for the superstructures for three bridges.

ROCKPORT, MO.—Bids will be received until June 2 for five steel bridges ranging from 40 ft. to 70 ft. each, to be built by Atchison County. C. A. Wells, County Clerk.

ST. PAUL, MINN.—Bridge improvements to be started soon include the substructure for the Grand avenue bridge to cost over $11,000, and paving Burr street bridge, at an expense of $5,000.

SIOUX CITY, IOWA.—J. M. Lewis, City Engineer, writes that the question of changing the channel of Floyd River is still undecided. If the change is made the Chicago & North Western Ry. will build a $65,000 bridge, and the city will build a bridge to cost about $12,000.

SYRACUSE, N. Y.—The State has appropriated $9,500 toward the cost of the Willow street bridge over Oswego Canal.

An appropriation of $4,000 has been made for widening the bridge over Oswego Canal at James street.

TAUNTON, MASS.—A new bridge over Taunton River at Weir is being considered.

TOPEKA, KAN.—A. Newman, County Clerk, will receive bids until June 8 for an 80-ft. low truss steel bridge to be built over Kaw River by Shawnee and Jefferson Counties.

TWEED, ONT.—Bids will be received until noon, June 12, for a 100-ft. steel overhead truss highway bridge to be built over Scoot River at Bridgewater, about five miles north of this place. Bids will be received at the same time for a 43-ft. steel bridge to be built in Madoc village. Wm. R. Aylesworth, County Clerk, Belleville, Ont.

UTICA, MO.—The County Court favors the building of a 192-ft. steel bridge over Grand River north of this place.

VERNON, IND.—The County Commissioners have asked for bids June 1 for two steel bridges over Six-Mile Creek in Spencer Township.

WASHINGTON, D. C.—The preparation of detailed plans and specifications for the Connecticut avenue bridge across Rock Creek will be taken up at once under Col. Biddle, Corps of Engineers U. S. A., Engineer Commissioner of the District of Columbia. The accepted design of George S. Morison is for an ornamental concrete bridge which will cost complete about $800,000. Of this amount $100,000 is available for work during the next fiscal year, and $79,000 has already been spent on foundations for piers.

Revised specifications have been approved for the proposed highway bridge over the Potomac River, and bids will soon be asked a second time for its construction. The number and length of spans will be the same as first provided for, but other changes give wide latitude to bidders in presenting their own designs, particularly in regard to the style of the draw, which may be either a horizontal swing span or of the bascule type. The total appropriation available is $996,000.

WICHITA, KAN.—It is reported that the County Commissioners have appropriated over $12,000 for the Derby bridge and a bridge over Little River.

Other Structures.

GOSHEN, IND.—The Kelly Foundry & Machine Co., it is said, will build a 40-ft. x 125 ft. addition to its foundry.

GRAFTON, W. VA.—It is reported that the Baltimore & Ohio is planning extensive improvements to its shops.

KANSAS CITY, MO.—It is reported that a company is to be organized with $125,000 capital, to build a malleable iron foundry. A. Basener, of the Griffin Wheel Works of Chicago, Ill., is named as President of the company, and John C. Stearns, of Kansas City, Secretary.

MEMPHIS, TENN.—It is stated that the Nashville, Chattanooga & St. Louis will build a $20,000 freight house.

NILES, MICH.—According to report, the Cleveland, Cincinnati, Chicago & St. Louis has acquired land to be used as a site for a new passenger station and freight house.

NORFOLK, VA.—The Seaboard Air Line shops and roundhouse are reported to have been destroyed by fire.

PITTSBURG, PA.—It is reported that the Geo. A. Hogg Iron & Steel Foundry Co. has chosen a site for a large plant at Rosslyn, a suburb of Pittsburg.

SWEETWATER, TEXAS.—The Texas & Pacific R. R. is expected to remove its machine shops from Big Springs to this place.

TERRELL, TEXAS.—T. Abbott & Son will replace their foundry recently burned by a foundry building 65 ft. x

100 ft.; machine shop, 40 ft. x 60 ft., and pattern shop, 30 ft. x 60 ft.

WASHINGTON, D. C.—It is announced that working drawings will be completed and bids asked for early in June for the new Union Station building, and that the work on foundations will begin probably by July 1.

WINCHESTER, KY.—The Louisville & Nashville and Chesapeake & Ohio are said to be planning a union passenger station.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ADIRONDACKS LAKE TRACTION.—Articles of incorporation have been filed by this company as a reorganization of the Mountain Lake Electric which recently went into a receiver's hands. The new company is capitalized at $60,000, with headquarters at Gloversville, N. Y. W. L. Weed, James Washburn, of Gloversville, and others, are interested.

AMITYVILLE & HUNTINGTON (ELECTRIC).—This company has been incorporated to build and operate an electric line from Amityville, N. Y., to the Long Island R. R. depot in Huntington, 14 miles. W. K. Putnam, A. S. Sherman, J. D. Brown, C. B. Smith and others, of New York city, are directors.

BALTIMORE & OHIO.—This company has decided to build a connection between its Belington, West Virginia Branch and the line extending from Weston to Pickens, W. Va., Buckhannon being the junction point on the latter branch. The new road will be 12 miles in length and will open up valuable timber and coal lands.

BANGOR & AROOSTOOK.—An extension will be built by this company from the Katahdin Iron Works, Me., north in the direction of Chesuncook and Chamberlain lakes, 50 miles.

BATESVILLE & JACKSONPORT.—Charter has been granted to this company to build from Batesville, Ark., southeast to Jacksonport, 22 miles. The road will parallel the St. Louis, Iron Mountain & Southern between these two points and will connect with the Choctaw, Oklahoma & Gulf at Jacksonport.

BOX CANYON & SANTA FE.—It is reported that this company has been organized in Arizona, to build from Congress Junction, Yavapai County, northwest to a point on the Bill Williams fork of the Colorado River in Mohave County, 40 miles. O. E. Greer, Congress Junction, is said to be interested.

BUCKHANNON & NORTHERN.—Contract has been awarded to McArthur Bros. for building 60 miles of this road from Colfax, W. Va., along the Tygarts Valley River to Belington, the present terminus of the West Virginia Central. Work will be begun at once. (May 1, p. 319.)

BURKESVILLE, GLASGOW & CUMBERLAND VALLEY.—Incorporation has been granted this company in Kentucky to build from Glasgow via Edmonton to Burkesville, 35 miles.

CHARLOTTE, MONROE & COLUMBIA.—The extension of this road from Hamburg to Jefferson, S. C., 11 miles, is practically completed. Grading is entirely finished and only five miles of track remain to be laid. Ernest Williams, Lynchburg, Va., is President.

CHESAPEAKE & OHIO.—An officer writes that this company is not making surveys for a branch line from the mouth of Blue Creek to the mouth of Twenty-mile Creek in West Virginia.

CHICAGO & NORTH WESTERN.—Surveys are in progress for an extension of this line to Sioux City, Iowa. Two routes are now being surveyed, one from Hawarden, Iowa, south to Sioux City, 40 miles, and the other from Centerville, S. Dak., southeast to Sioux City, 50 miles. It is not known which of these routes will be selected.

CHICAGO, MILWAUKEE & ST. PAUL.—An officer writes that work is already in progress on the extension of this line from Woonsocket, S. Dak., west to Wesington Springs, 15 miles. Contract for grading and bridge and culvert work has been let to Foley Bros., Minneapolis. A small portion of the grading has already been done but no track has been laid. The character of the work is light, with a maximum grade of 1.2 per cent., and maximum curvature of 3 deg. There are no important bridges or tunnels. (May 15, p. 351.)

COEUR D'ALENE & SPOKANE (ELECTRIC).—Contract has been awarded to A. S. Eslick and M. D. Wright, of Spokane, Wash., for grading this line from Cœur d'Alene, Idaho, to Spokane, Wash. (May 22, p. 368.)

COLORADO, OKLAHOMA & TEXAS.—This company has amended its articles of incorporation. The amendment provides for the building of a line from Pueblo, Colo., to Denison, Texas, 450 miles. The line will pass through the southwestern portion of the Chickasaw Reservation, and through Comanche, Kiowa, Washita and other counties in Oklahoma. E. E. Colby, Hobart, Okla. T., is Chief Engineer. (May 15, p. 351.)

DELPHOS & NORTHERN.—This company has been incorporated in Ohio to build from Delphos, on the Cincinnati, Hamilton & Dayton, northwest through the Counties of Allen, Van Wert, Putnam, Defiance, Henry and Fulton, about 60 miles. J. B. Child, W. S. Parks, L. C. Maxwell and others, of Columbus, are interested.

DENVER, YANKEE HILL & WESTERN.—An officer writes that surveys have been finished for this line from Central City, Colo., west via Russell Gulch to Glacier City. Grading will be begun early in June. R. A. Hall, Cedar Rapids, Iowa, is the contractor, but he will sub-let a part of the work. The work will be heavy, with maximum curves of 20 deg. J. C. McShane is President, and G. R. Steuart, Vice-President, Denver, Colo. (May 22, p. 368.)

FAIRMONT & CLARKSBURG TRACTION.—This company has been incorporated to build an electric line from Burnsville, W. Va., northeast to Clarksburg, W. Va., 35 miles. S. L. Watson, L. L. Malone and M. L. Hutchinson, of Fairmont, W. Va., are incorporators.

FLINT RIVER & NORTHEASTERN.—Application for a charter is now being made by this company in Georgia. It is proposed to build from a point on the Flint river to Pelham, Ga., with branches to Hartsfield, in Colquitt County, and to Carlisle in Worth County.

FORT WAYNE & NORTHEASTERN.—This company has been incorporated in Ohio, to build from Bryan, Williams County, west to the Indiana State line, 15 miles. R. M. Barton is interested.

GRAND RAPIDS ELECTRIC.—Incorporation has been granted this company in Michigan, to build an electric line from Grand Rapids northeast through the Counties of Kent, Montcalm, Mecosta, Isabella and other counties to a point on Lake Huron not yet determined; also a branch line from Grand Rapids southeast through Barry, Eaton and Ingham Counties to Lansing. The length of the entire line, including branches, will be about 250 miles. C. J. Post, M. C. Weaver, and others, of Grand Rapids, are interested.

HARPSWELL & BRUNSWICK (ELECTRIC).—Work will be begun at once on this electric line from Brunswick, Me., south to Harpswell, 16 miles. Connection will be made with the Maine Central at Harpswell. C. E. Townsend, Brunswick, is President, and H. R. Jordan, Saco, Me., Treasurer.

LARAMIE, HAHNS PEAK & PACIFIC.—Grading is reported completed from Laramie, Wyo., to Centennial, 35 miles. A contract for 3,000 tons of 60-lb. steel rails has been let to the Carnegie Steel Co., and track laying will be begun at once. R. D. Stewart, Laramie, Wyo., is Chief Engineer. (May 1, p. 320.)

MARKED TREE & WESTERN.—A charter has been granted this company to build from Marked Tree, Ark., to a point in the western part of Poinsett County 20 miles. Connection will be made with the St. Louis & San Francisco at Marked Tree. D. P. Mann, Jonesboro, and O. K. Warren, Marked Tree, are incorporators.

MEXICAN ROADS.—The Mexican Government has granted a concession to Salvador Pena and to Rafael Davila, of Saltillo, Mexico, for building and operating a narrow gage railroad from Allende north to Zaragoza, 20 miles. The proposed line will connect with the Mexican International at Allende.

The Pittsburg-San Jose Reduction & R. R. Co. has finished the grading of its line between San Jose del Sitio and Gavalina, in the State of Chihuahua, Mexico, 16 miles. Track laying will be begun at once. The road will eventually be extended to a connection with the Kansas City, Mexico & Orient at Bocoyna. M. B. Place, San Jose del Sitio, is General Manager.

MICHIGAN CENTRAL TRACTION.—This company has been incorporated in Michigan to build an electric line from Lansing through Grand Ledge, Charlotte, Bellevue and Olive to Battle Creek, 57 miles. The company is capitalized at $1,300,000, and the directors are J. W. Ewing and J. S. Mudge, Grand Ledge, and E. T. Pangborn, Battle Creek. It is reported that a contract for building this line has been let to M. W. Burwell, New Haven, Conn.

MILLEN & SOUTHWESTERN.—It is reported that this company is about to build an extension from its present terminus at Stillmore, Ga., southwest to Vidalia, 23 miles, where a connection will be made with the Seaboard Air Line. F. R. Durden, Stillmore, is General Manager.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—An officer writes that the extensions from Glenwood, Minn., will run north via Alexandria, Parker's Prairie, Henning and Detroit to the Wild Rice River in the White Earth Indian Reservation in Norman County, 125 miles. Contract for grading and bridges has been let to Richards, Lundeen & Co., of Minneapolis. The character of the work is light, with maximum grades of 5 per cent., and maximum curvature of 3 deg. (May 15, p. 352.)

MISSOURI, KANSAS & TEXAS.—Work is reported begun on an extension of the Krebs Branch of this road from Garvin's Creek, Ind. Ter., northeast to a point near Quinton, where connection will be made with the Fort Smith & Western.

MORGANTOWN, FAIRMONT & CHEAT RIVER.—This company has been incorporated in West Virginia, to build from a point in Marion County to Morgantown, 35 miles. The capital stock is $750,000 and the incorporators are H. G. Davis, S. B. Elkins, T. R. Dillie and others.

NORTHERN CENTRAL CONNECTING.—A charter has been granted to this company to build a cut-off to connect the Northern Central at Selinsgrove Junction with the main line of the Pennsylvania R. R. at Aqueduct, Perry County, 35 miles.

PEARL & LEAF RIVER.—Contract has been awarded to Bowles & Hemingway, Jackson, Miss., for grading the proposed extension of this road from Prentiss to Silver Creek, nine miles, connecting at the latter point with the Columbia-Mendenhall branch of the Gulf & Ship Island. (May 8, p. 336.)

PENNSYLVANIA.—Plans for the tunnels under the North and East Rivers, New York, have been approved. The specifications have been prepared and bids will shortly be asked for building the tunnels.

PERE MARQUETTE.—It is reported that work will be begun within a short time on the proposed extension of this road from Harbor Beach north to Port Hope, Mich., six miles.

QUINCY & ILLINOIS WESTERN (ELECTRIC).—The proposed route of this road is from Quincy, Ill., east to Beardstown, with a branch north to Niota. Surveys have been completed between Quincy and Beardstown and work will be begun at once. The Bracey-Howard Construction Co., of Chicago, Ill., is the contractor. (March 20, p. 220.)

ST. JOSEPH, PARKVILLE & KANSAS CITY (ELECTRIC).—A charter has been granted to this company to build from St. Joseph, Mo., south via Leavenworth, Kan., to Kansas City, 50 miles. J. J. Tootle, St. Joseph; J. L. Brown, Kansas City; H. B. McAfee, Parkville, Mo., and others are incorporators.

ST. LOUIS & ST. PAUL.—A charter has been granted this company in Missouri to build from the Iowa State line through Scott, Knox, Shelby, Monroe and other counties to Mexico, Mo., 150 miles. The incorporators are: S. F. Scott, T. S. Ridge, R. D. Katlein and A. C. Kinnead, all of Kansas City.

ST. LOUIS & SAN FRANCISCO.—Surveys have been ordered for an extension of this line from Vernon, Texas, southwest to Stamford, 90 miles. Connection will be made with the Texas Central at Stamford, the present terminus of that road.

SAN FRANCISCO & EUREKA.—Incorporation has been granted this company in California. A. W. Foster, G. A. Newhall, G. A. Pope and J. W. Lilienthal are incorporators. The purpose of the new company is to build the California Northwestern in a northerly direction from its present terminus at Willits, Cal. Capital stock $10,000,000.

SAN JOSE & LOS GATOS INTERURBAN.—Articles of incorporation have been filed by this company in California. The proposed route is from San Jose to Los Gatos, and Saratoga, about 18 miles. The company is capitalized at $2,000,000. J. W. Rea, C. W. Cobb, F. S. Granger and G. W. Waldorf, all of San Jose, are directors.

SPRINGFIELD, MOWEAQUA, SULLIVAN & MATTOON.—Articles of incorporation have been filed by this company in Illinois, to build from Springfield southeast through Moweaqua and Sullivan to Mattoon, 70 miles. S. W. Wright, Jr., Sullivan, Ill.; J. W. Jefferson, Springfield; I. B. Craig, Mattoon, and others are incorporators.

TEMISKAMING & NORTHERN.—It is reported that grading has been finished for a distance of 35 miles from North Bay, and that track laying will be begun immediately. The line has been located for a distance of about 60 miles to a point in the middle of the Temagaming Forest Reserve. A. R. McDonnell, North Bay, Ont., is the contractor. (See Construction Supplement.)

TENNESSEE CENTRAL.—An officer writes that the extension of this road from Nashville to Clarksville is practically completed. Grading is now in progress between Clarksville and Hopkinsville, 30 miles. W. J. Oliver & Co., Pittsburg, Pa., are the contractors. (See Construction Supplement.)

VANCOUVER, VICTORIA & EASTERN.—Contract has been awarded to Siems & Shields, of St. Paul, for building this line from Grand Forks, B. C., northwest to Phœnix, 24 miles. Work will be begun immediately. (May 8, p. 336.)

VERA CRUZ & PACIFIC.—This road was opened on May 16. The line runs from Cordova to San Lucrecia, on the Isthmus of Tehuantepec, where connection will be made with the National Tehuantepec R. R.

VINITA NORTHWESTERN.—It is reported that this company has been organized in Indian Territory to build a railroad from the Kansas State line at a point near Coffeyville, to Vinita, and thence to Grand River. C. N. Haskell, Ottawa, Ohio, is said to be interested.

TUG FORK & GILBERT CREEK.—This company has been incorporated to build from Wharncliffe, Mingo County, W. Va., west to the mouth of Gilbert Creek, 10 miles. The line, when completed, will parallel the Norfolk & Western for the greater part of the distance. C. W. Campbell, C. E. Haworth and F. S. Chapman, Huntington, W. Va., are incorporators.

WABASH & MARION.—Press reports state that this new line, between Wabash, Ind., and Marion, will shortly be built. Rights of way have been secured and it is said that contracts for grading will be let in the near future. The distance between the two cities is 30 miles, and the new line will parallel the Michigan Division of the Cleveland, Cincinnati, Chicago & St. Louis for the greater part of the distance.

WESTERN MARYLAND.—Bids are now being asked for building the extension from Cumberland, Md., to Cherry Run, 65 miles. Surveys have been finished and rights of way secured. (May 15, p. 352.)

WESTERN PACIFIC.—It is reported that this company will cross the Sierra Nevada range at an altitude of 6,500 ft., which will necessitate about 4½ miles of tunnels. The road will run from Oroville, Cal., through Beckwith Pass to a point on the California State line. (May 15, p. 352.)

ZANESVILLE, MARIETTA & PARKERSBURG (WABASH).—Notice has been filed with the Secretary of State in Ohio of the proposed change of route of this road. The new line will run from Zanesville through Roseville, Dovertown, Sayre, Sharpsburg, Big Run and Cutler to Parkersburg, W. Va., 80 miles. No reason is given for the change of route. (April 10, p. 274.)

GENERAL RAILROAD NEWS.

CHICAGO, ROCK ISLAND & PACIFIC.—The Railroad Commission in Texas has issued an order refusing to sanction the contract recently made between the Chicago, Rock Island & Pacific and the Southern Pacific, for the joint operation of the lines of the Houston & Texas Central, the Houston East & West Texas, the Texas & New Orleans, and the Galveston, Houston & Northern. The principal reason for rejecting the contract is that the Rock Island has no authority, under its Texas charter, to purchase the stock of other railroad corporations: and the agreement between the Rock Island and Southern Pacific is held to be unlawful, in that it practically prevents competition between them.

DETROIT & TOLEDO SHORE LINE.—It is officially reported that the receiver of this company will be discharged before June 1, and that the property will be taken over by the Grand Trunk at that time. All claims against the company have been settled, and an issue of $2,000,000 4 per cent. bonds has been guaranteed by the Grand Trunk. (May 1, p. 320.)

DETROIT SOUTHERN.—At a recent meeting of the holders of the voting trust certificates of this company, authority was given to increase the capital from $17,000,000 to $26,000,000. The additional $9,000,000 will be used for several branch lines, the chief one of which is now being built from Bloom Furnace, Ohio, to Ironton, 18 miles. (May 15, p. 352.)

GRAND TRUNK.—See Detroit & Toledo Shore Line above.

GREAT NORTHERN OF CANADA.—This company has completed arrangements for the lease of all the lines of the Chateaugay & Northern and of the Montreal Terminal. By the conditions of the lease, the Great Northern will have the right of way from Joliet to Montreal, over the tracks of the Montreal Terminal Co. It will thus not only gain a terminus in Montreal, but on the completion of the Chateaugay & Northern, it will have a line to every important town north of the St. Lawrence, in the Province of Quebec, and also the shortest line between Quebec and Montreal. (Jan. 9, p. 38.)

WASHINGTON COUNTY (MAINE).—A suit has been brought by the Central Trust Co. as mortgage trustee, to foreclose this company's mortgage, and for the appointment of a receiver. No interest has ever been paid on the $2,142,000 of 5 per cent. bonds. It is reported that when the company is reorganized, it will be taken over by the Boston & Maine.

PENNSYLVANIA.—Announcement has been made that Speyer & Co., and Kuhn, Loeb & Co. have underwritten the new issue of stock of the Pennsylvania which was authorized on March 10 last. The terms of the underwriting have not been entirely given out, but it is understood that the total amount of the stock to be issued is $75,000,000, or one-half of the amount authorized. The syndicate has agreed to take over at 120, less 2 per cent. commission, all of the stock that is not subscribed for by the stockholders. The new stock is payable in three installments: one of 50 per cent. between June 15 and June 27; one of 25 per cent. between Oct. 15 and Oct. 26, and the last quarter on June 15, 1904.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—A $50,000,000 mortgage has been filed by this company with the Mercantile Trust Co. of New York as trustee. This is to secure an issue of bonds which was recently authorized by the directors. The bonds are to be 30-year 4 per cent. first mortgage, and are to be a lien on the proposed new lines, to be known as the River & Gulf Division of the St. Louis, Iron Mountain & Southern. For particulars with regard to this bond issue, see March 6, p. 176.